International Edition

January 1985 Issue #292
$2.50 USA / $3.00 Canada

73®

Amateur Radio's Technical Journal

A CWC/I Publication

Build It!
8 Great Projects

Repeater Peeper
Page 50

Soup Up Your IC-730
Page 10

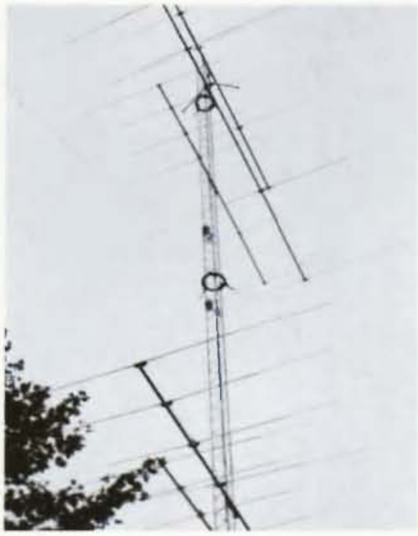
Radio Robotics?
Page 30

VIC Memory Expan ion
2 cles

R Y R ipe
Pag 6

30 Wat VH Bla ter
Page 4

6-M eter Wildcat!
Page 57



Winning—7

Linosa Island—89

Eight Mods for the IC-730
Customize your ICOM! Snip here, solder there, and enjoy perfection N6HI 10

VIC RAMification: Part I
Here's how to turn 3 ICs and half an hour into 24K of extra VIC-20 memory ..... Brefini 18

VIC RAMification: Part II
W6LOB fills the 3K gap of Part I with a quick piggyback RAM expansion W6LOB 22

Transistors: A Biased Approach
In Part II, we evaluate base current and gain and use this information to design a working transistor circuit ..... KCØEW 26

Automate the FT-757
Ready for robot radio? An inexpensive micro is all that you need to computer-control your Yaesu KA6IFQ 30

That Glorious Gonset
With 300 Watts on 2 meters, the Gonset 972 thumbs its nose at solid state. Rebuild one and be heard! KT2B 34

A Space-Saver Seven Megger
Stuffing full-wave 40m loops into tiny places is W8TYX's specialty. We finally got him to tell us how he does it W8TYX 44

Shoestring RTTY
Build a commercial-quality computer interface for under $30 ..... W9ODK 46

Is Your Repeater Dying?
With this 16-channel telemetry encoder, you have a remote chance of finding out WA4TEM 50

How Good Is Six?
Try 50 MHz with a transceiver you've built from scratch. There's no greater pleasure than saying, "I did it myself!" KL7GLK 57

Blast Away—34

Never Say Die—4
What?—6
QRX—7
Barter 'N' Buy—56
Special Events—65
Review—66
DX—67
Letters—69
RTTY Loop—70
Satellites—71
Ham Help—71, 74, 91
Awards—72
Reader Service—80
New Products—82
Contests—84
Fun!—85
73 International—88
Dealer Directory—94
Propagation—94

73: Amateur Radio's Technical Journal is a member of the CW Communications/Inc. group, the world's largest publisher of computer-related information. The group publishes 53 computer publications in 24 major countries. Nine million people read one or more of the group's publications each month. Members of the group include: Argentina's *Computerworld/Argentina*; Asia's *The Asian Computerworld*; Australia's *Computerworld Australia*, *Australian Micro Computerworld*, *Australian PC World* and *Directories*; Brazil's *DataNews* and *MicroMundo*; China's *China Computerworld*; Denmark's *Computerworld/Danmark* and *Micro Verden*; Finland's *Mikro*; France's *Le Monde Informatique*, *Golden* (Apple) and *OPC* (IBM); Germany's *Computerwoche*, *Microcomputerwelt*, *PC Welt*, *Software Markt*, *CW Edition/Seminar*, *Computer Business* and *Commodore Magazine*; Italy's *Computerworld Italia*; Japan's *Computerworld Japan* and *Perso ComWorld*; Mexico's *Computerworld/Mexico* and *CompuMundo*; Netherland's *CW Benelux* and *Micro/Info*; Norway's *Computerworld Norge* and *MikroData*; Saudi Arabia's *Saudi Computerworld*; Spain's *Computerworld/España* and *MicroSistemas*; Sweden's *ComputerSweden*, *MikroDatorn*, *Min Hemdator* and *Svenska PC World*; the UK's *Computer Management*, *Computer News* and *Computer Business Europe*; the US's *Computerworld*, *Hot CoCo*, *inCider*, *InfoWorld*, *MacWorld*, *Micro Marketworld*, *Microcomputing*, *PC World*, *RUN*, *73* and *80 Micro*.

MPA

INFO

Manuscripts

Contributions in the form of manuscripts with drawings and/or photographs are welcome and will be considered for possible publication. We can assume no responsibility for loss or damage to any material. Please enclose a stamped, self-addressed envelope with each submission. Payment for the use of any unsolicited material will be made upon acceptance. All contributions should be directed to the *73* editorial offices. "How to Write for *73*" guidelines are available upon request. US citizens must include their social security number with submitted manuscripts.

Editorial Offices:

Pine Street
Peterborough NH 03458
Phone: 603-924-9471

Advertising Offices:

Elm Street
Peterborough NH 03458
Phone: 603-924-7138

Circulation Offices:

Elm Street
Peterborough NH 03458
Phone: 603-924-9471

Subscription Rates

In the United States and Possessions:
One Year (12 issues) $25.00
Two Years (24 issues) $38.00
Three Years (36 issues) $53.00

Elsewhere:

Canada and Mexico—$27.97/1 year only, U.S. funds. Foreign surface mail—$44.97/1 year only, U.S. funds drawn on U.S. bank. Foreign air mail—please inquire.

To subscribe, renew or change an address:

Write to *73*, Subscription Department, PO Box 931, Farmingdale NY 11737. For renewals and changes of address, include the address label from your most recent issue of *73*. For gift subscriptions, include your name and address as well as those of gift recipients.

Subscription problem or question:

Write to *73*, Subscription Department, PO Box 931, Farmingdale NY 11737. Please include an address label.

73: Amateur Radio's Technical Journal (ISSN 0745-080X) is published monthly by CW Communications/Peterborough, Inc., 80 Pine Street, Peterborough NH 03458. Second class postage paid at Peterborough NH 03458 and at additional mailing offices. Entire contents copyright © 1984, CW Communications/Peterborough, Inc. All rights reserved. No part of this publication may be reprinted or otherwise reproduced without written permission from the publisher. Microfilm Edition—University Microfilm, Ann Arbor MI 48106. Postmaster: Send address changes to *73*, Subscription Services, PO Box 931, Farmingdale NY 11737. Nationally distributed by International Circulation Distributors.

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

The response to my editorial asking for letters from hams interested in a DXpedition to Taiwan has been underwhelming. One.

I visited Tim Chen BV2A, the only licensed amateur on Taiwan, in October and he is still enthusiastic. He says that the government will cooperate if there are any Americans interested in operating from this very rare country for a few days.

I was looking at this DXpedition as a test to see if there would be any interest in *73* organizing a series of DXpeditions to the rarer countries. I had in mind DXpeditions with about a dozen hams so we would be able to operate stations around the clock for about four days in each spot. This would make most trips last about a week—allowing one day to get there, one to set things up, four days to operate, and one to get home.

By running a series of DXpeditions, *73* would be able to assign one ham full-time to organizing the efforts, going along to help with the formalities, and setting up the stations. A second ham would be in charge of the filming and videotaping of the DXpedition, as well as the PR for it, nationally and internationally.

Such a DXpedition series could generate considerable interest in amateur radio via exposure on television and in magazines and newspapers.

Here is the group of hams that got together for dinner in Hong Kong in October—about a dozen VS6 and a dozen US hams.

Indeed, we need something dramatic such as this if the hobby is going to survive. I doubt if you realize how far down the new ham numbers have sunk. Just this year we've dropped from almost 3,000 new hams a month to about 700. If the curve of new licensees of the last two years continues as it has, we will reach zero per month in 1986.

While we have had a slight growth in the number of total licensed hams in the last twenty years, surveys indicate that much of this is due to the license being free and running for five years. The number of active American hams has dropped by about 46% in twenty years. We sure need something!

A series of well-publicized DXpeditions could conceivably generate interest in the hobby. I estimate that it would cost about $3,000 for each of a dozen hams going on the trip to make

Continued on page 72

QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, 80 Pine Street, Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

QRX. . .

EDITED BY PERRY DONHAM KW1O

WARC Wish?

THE WARCS ARE COMING! The FCC has released a Notice of Proposed Rulemaking (PR Docket 84-960) that details the implementation of our new allocations. Here's what they've got in mind.

- 30 METERS: Amateurs with a General-class license or above will have 10.100 to 10.150 MHz available for CW or RTTY, with no special power limitation. Effective immediately, the 10.109 to 10.115 "window" no longer exists. Remember, you're still allowed only 200 Watts PEP on this band.
- 17 METERS: Forget about the 18.068-18.168 segment for a while. The FCC says that access to this band will not be available until 1989.
- 12 METERS: Things are a bit brighter for the 24.890 to 24.990 allocation. The National Telecommunications and Information Administration (NTIA) says that shared use of the band by amateurs with government fixed stations would not be a problem. The Commission would like to open this band as soon as possible. Right now, the band plan looks like this: 24.890-24.930 CW/RTTY and 24.930-24.990 CW/SSB. Amateurs with a General or higher license will be allowed to operate on 12 meters, with no special power restrictions.

Remember, these are just proposals—with the exception of 30 meters, you can't use these new frequencies until the FCC issues a final Report and Order. Watch "QRX" for further details.

Megachamp!

OUTRAGEOUS is the word that came to mind when I opened a letter from **John Kanzius K3TUP.** John has won *73*'s 40-meter SSB Championhip for two years running, and he wanted us all to see why. The antenna in the photograph is a KLM 4-element monobander. I don't want to know how high it is! What isn't shown is the rest of the farm: 6 over 6 on 10 and 15 meters, 6 over 5 on 20 meters, a 4-element phased vertical array for 80 meters, and a W1CF quarter-wave sloper on 160 meters! For the curious, John says that the aluminum is .9 wavelengths high for the lower antennas and 2.25 wavelengths up for the rest! Feeding all of this are a pair of Kenwood TS-930Ss, a Rockwell KWM-380, and an Alpha 77D. Any more questions?

220 Vote!

TWO VERY IMPORTANT VOTES are due soon from the FCC. The first involves the **LMCC petition** for additional spectrum in the land-mobile service. The inside scoop is that LMCC will not receive any allocation in the 800-MHz reserve, and that leaves chunks of 220 MHz up for grabs. If this vote goes against amateur radio, it will mean an NPRM aimed at an orderly transition to commercial interests on this band. The other vote concerns the highly-touted Personal **Radio Communication Service (PRCS)**, which seemed to be a low-cost alternative to cellular telephone. General Electric, which already has invested millions of dollars in research and development, decided to table their efforts early last week. This clears the way for the Commission to lay PRCS to rest.

Head Ham

RAJIV GANDHI, Prime Minister of India, is also VU2RG! His Excellency is not the only ham in the Gandhi family—**Sonia Gandhi**, Rajiv's spouse, holds VU2SON. How long will it be before we hear a "heads of state" net on 20 meters?

Log Jam

ON THE DX FRONT, there's bad news from Africa. What used to be XT Upper Volta is now **XT Burkina Faso**. The bad news is that the new name doesn't fit the "QTH" column in the logbook! From **Gus Browning**'s *DX'ers Magazine* comes word of an expedition to ZA Albania, and the word is, "Don't hold your breath..." According to Gus, several DL stations are trying to gain permission to operate, including DJ0UJ, but chances are less than slim that governmental blessings will be issued. The *DX'ers Magazine* is a good way to stay on top of the changing DX scene, and you can reach Gus at PO Drawer DX, Cordova SC 29039.

K3TUP's monster aluminum.

Packet Draft

A NATIONAL PACKET REGISTRATION PROGRAM is underway through the auspices of the **Central Illinois Packet Radio User Society (CIPRUS).** These folks are trying to create a list of every packet-radio enthusiast in the country. If you are active on this mode, please send the following information to CIPRUS: callsign, name, address, and miscellaneous information (digipeater, mailbox, grid locater, etc.). Mail this, along with a very large SASE, to CIPRUS, PO Box 4143, Peoria IL 61607. This kind of service does not come cheaply. According to **Greg Smith N9AGC**, "...we will not turn down any donations toward paper costs that you would care to make."

Form Fact

A NEW FORM 610 is being passed out by the FCC. It reflects the changes in the testing structure and includes spaces for VE certification. Your local VEC or the FCC can supply you with a copy.

Digital Paper?

THE FOURTH ARRL Radio Computer Networking Conference will be held in San Francisco, California, on March 30, 1985. Technical papers are being solicited on all aspects of amateur digital communications, including packet switching, meteor scatter, and satellite systems. Topics may include network architecture, proposed standards, hardware/software, protocols, modulation and encoding schemes, applications, and practical experience. The deadline for camera-ready manuscripts is March 1, 1985. Papers should be mailed to Marian Anderson WB1FSB, ARRL, 225 Main Street, Newington CT 06111. If you plan to present a paper, you should request an author's kit and identify the title of your proposal as soon as possible.

ICOM, They Go

AFTER READING IN "QRX" that *73* had moved to plush new offices, **ICOM America, Inc.**, decided to do the same. They've built a beautiful new 40,000-square-foot corporate headquarters in Washington State. The new address is: ICOM America, Inc., 2380-116 Avenue NE, Bellevue WA 98004. I've seen a picture—the building looks like a giant IC-02AT lying on its side!

John L. Rehak N6HI
8701 MacAlpine Road
Garden Grove CA 92641

Eight Mods for the IC-730

Customize your ICOM! Snip here, solder there, and enjoy perfection.

I have owned my ICOM 730 for over two years now, and I am still continually impressed with the high performance of this fine example of modern technology! However, I am a perfectionist, and I honestly don't think it is very likely that any manufacturer will ever create a rig that would be "perfect" for my tastes. They all seem to overlook one or two things, but they are getting closer all the time!

I have always found that the best way to obtain the perfect ham rig (or anything else) when it is not readily available is to take the closest available thing and adapt it to suit my individual requirements. With that thought in mind, I proceeded to design and install several easy modifications for the IC-730 that I feel have enhanced its "proximity to perfection." I will describe each modification separately to give you the opportunity to consider each on its own merits. You then can determine whether to add any of these enhancements to your own IC-730. None of the modifications is difficult to accomplish, and some are almost no work at all!

Sidetone-Pitch Control

The IC-730 does not include a control to adjust the pitch of the internal CW sidetone oscillator. I consider this an essential feature because in my home station I frequently use narrow active audio filters for enhanced CW reception. If the pitch of the sidetone oscillator in the 730 does not just happen to match the center frequency of any external audio filter you are using, the sidetone will be lost forever in passing through the audio filter, requiring you to switch the filter in and out each time you change between transmit and receive!

An extremely simple modification will allow you to add a convenient sidetone-pitch control that can be adjusted by turning a control inside the hatch cover on the top which allows access to the auxiliary controls. Adjusting this new control will allow you to match the sidetone pitch easily to any external filter you are using.

To create this new sidetone-pitch control, simply remove the fixed resistor, R109, on the main circuit board (refer to the ICOM 730 operating manual) and replace it with a 20k subminiature trimmer. Component spacing is a bit tight, so this will require a very small trimmer.

The new tone-adjust control is not only useful if you are using external audio filters; it is also very convenient to be able to vary the audio pitch to suit individual operator preferences. Changing the pitch from time to time can help reduce operator fatigue during long periods of CW operation.

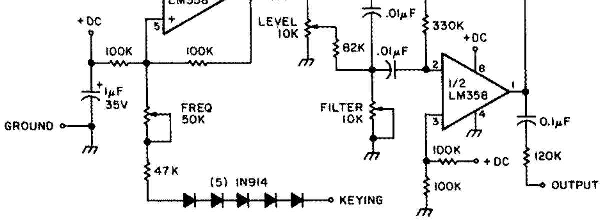


Fig. 1. Improved sidetone oscillator for the ICOM 730.

Improved Sidetone Oscillator

Although the sidetone-pitch control described above does solve the problem of adjusting the sidetone-oscillator pitch, there is another characteristic of the IC-730 sidetone oscillator that bugged me: The stock sidetone-oscillator circuit produces an irritating click on make-and-break during CW keying. This apparently is caused by the clamping action of transistor Q16 in the sidetone circuit

After several unsuccessful attempts to modify the oscillator circuit to correct this, I came to the conclusion that perhaps the best approach would be to abandon ICOM's oscillator circuit completely and design a new circuit that would produce the desired clean-sounding sidetone with no annoying clicks. To create this circuit, I borrowed on one of my earlier efforts, a code-practice oscillator circuit (see "The Penultimate CPO," *73*, September, 1980), and modified it to be controlled by the ICOM 730 keying circuits.

Fig. 1 is a schematic diagram of the improved sidetone-oscillator circuit. It requires that only four connections be made to the 730. I constructed this audio-oscillator circuit on a small piece of perfboard and installed it under the hatch cover on the rig's top. This location allows you to adjust the circuit's pitch and output volume easily.

The procedure for installing the new oscillator is as follows: First, locate green jumper wire F on the main circuit board and cut it near the end that is near transistor Q16. Tape over the Q16 end and tuck it aside. The

four connections for the new circuit may now be made:

- The +dc power connection goes to control line CW8, available at pin 4 of J13 on the main circuit board.
- The ground connection goes to SPE, the speaker ground, available at pin 2 of J18 on the main circuit board.
- The keying connection goes to KEY line, available at pin 3 of J18 on the main circuit board.
- The output connection goes to either end of resistor R114 on the main circuit board.

To adjust the new sidetone oscillator, proceed as follows: Key down (dummy load, please!) and adjust the FREQ control to 750 Hz or your preferred pitch. Then adjust the FILTER control to the same frequency by adjusting it for the loudest and clearest-sounding output tone. Last, adjust the LEVEL control for the desired output volume.

Although the improved sidetone-oscillator circuit is a bit more work than the other modifications in this article, I'm sure that if CW operation is one of your main interests, you will agree that the beautiful clean-keyed sine wave that this oscillator circuit produces is worth the extra work!

Improved CW-Filter Switching

When both the FL-45 CW crystal filter (500 Hz) and the EX-203 active audio filter options are installed, the stock filter-switching arrangement that ICOM designed seems backwards: It works out so that when you are in either CW mode (CW or CW-n, the narrow position), the 150-Hz-wide EX-203 audio filter is switched in, but the 500-Hz-wide FL-45 filter is switched in only in the CW-n position.

If you stop and think about this, I'm quite sure you will agree that it doesn't seem to make much sense to leave a 150-Hz-wide filter in the circuit and switch a 500-Hz filter in and out; the exact opposite makes much more sense: Leave the 500-Hz filter in the circuit in both CW mode positions and add the 150-Hz active audio filter into the circuit only in the narrow CW position.

Fortunately, the 730 is "cold switched." This means that rather than actually rerouting signals directly through front-panel switch contacts, most 730 panel switches actually switch a dc control voltage which controls signal routing on the boards. To rewire the 730 to allow for the improved CW-filter switching, proceed as follows:

- Remove the green wire from pin 1 of plug P-1 which "hangs" off the EX-203 filter board and carefully fish it out of the short cable into which it is harnessed. Let this green wire hang free for now, and mount the EX-203 as per ICOM installation instructions.
- Locate the two wires, green and blue, coming from P-6, plugged into J4 on the second i-f board. Cut both these wires at the point where they pass behind the center of the S-meter. The short end of the blue wire may be taped at the end and discarded. (Tuck into nearby wiring.) The short green wire should be connected via a length of insulated wire (preferably green) to the green wire which you pulled out. Tape over all connections to prevent possible shorts.
- Two wires are left to connect: the long blue and the long green. Splice the long green to the white wire coming from pin 1 of J1 on the detector board.
- Splice the long blue to the red wire coming from pin 4 of J1 on the detector board. Again, tape over all spliced connections.

Improved Audio-Filter Operation

My EX-203 active audio CW filter, as supplied, rings and adds audio distortion. To tame it down, I replaced both resistors R2 and R9 (originally 560k) with 270k resistors. This cleaned things up nicely and provided nearly equal audio-output level from a centered signal whether the filter is switched in or out.

After the resistors have been changed, re-peak the two filter stages by adjusting R7 and R14 trimmer potentiometers on the EX-203 board for maximum output with a 750-Hz audio note, with the rig in the narrow CW mode and a medium-strength carrier received.

I believe that optimum adjustment of an audio filter is somewhat a matter of individual taste. If you wish to experiment with the characteristics of the EX-203 audio filter, you will find that (1) overall gain can be adjusted by changing the value of resistors R1 and R8, (2) bandwidth can be adjusted by changing the value of resistors R2 and R9, and (3) center frequency may be adjusted by varying the value of resistors R7 and R14. All these values interact somewhat, so you may have to play with resistor values awhile to get exactly the characteristics you prefer.

Panel-Lamp Brilliance

The panel-meter illumination from the S-meter on the 730 is very bright, and I found that to be distracting during mobile operation. It was so bright that it made me squint when I looked at it, and it seemed to disturb my night vision. Fortunately, there is an extremely simple fix for this problem: Simply break the path of the source wire that feeds dc to the S-meter lamp and insert a 24-Ohm, 1/2-Watt resistor in series with it. Tape over any exposed connections to avoid potential shorts later.

The S-meter lamp will now glow a mellow yellow color, much dimmer than the stock configuration but still plenty bright enough to read the meter very easily. A bonus is the much-prolonged bulb life you may now expect due to the lower bulb current.

Auto Memory Hold

The 730 has two vfo frequency memories plus a memory for each band. Unfortunately, whenever you turn the power off, all memories are lost. During mobile operation, this means that if you turn the rig off when you leave the car, you will have to reprogram all the memories when you return. A simple modification will allow the 730 to keep its memories alive even when the rig's power switch is off, so long as the rig remains connected to a source of +12-volt-dc power. To implement this change, proceed as follows:

- Remove the red wire plugged into jack J8 on the logic unit.
- Cut the plug off this red wire and set it aside. Tape over the end of the red wire so that it cannot short to anything and hide it away in a group of nearby wires.
- Solder a 10-inch wire to the top-rear terminal of the power switch. Route this wire along any convenient cable bundle to jack J8 on the logic unit.
- Solder the plug that was cut from the red wire to the free end of the new power-switch wire (discarding any excess length) and plug it into J8 on the logic unit.

Both vfo frequencies and all band memories will now be held in memory as long as dc power remains supplied to the rig's main power connector. Current drain when the rig is turned off will be about 18 mA—not a significant drain on your car battery, and a small price to pay to avoid the nuisance of having to reprogram memories every time you return to your car!

This modification comes

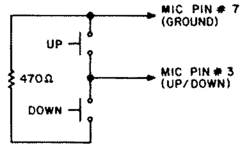


Fig. 2. Adding up/down tuning to the ICOM 730.

with a free bonus: The memory jack on the rear of the rig now connects to nothing, so you may feel free to use it for any desired spare function via the taped red wire that was cut from the J8 plug.

Up/Down-Tuning Microphone

I must admit it: I have tried ICOM's own optional up/down-tuning mobile microphone for the 730 and I didn't like it for two important reasons. First, it has a very uncomfortable box shape, the feel of which I did not care for, and second, the push-buttons are too hard to push—and especially to hold down for the prolonged period of time required to scan across a band.

I solved this problem by carefully removing the microphone cartridge and preamplifier from the handheld microphone supplied and carefully repackaging them into a microphone I liked better (that had the necessary push-buttons for up/down tuning). This preserved the exact audio characteristics of the original stock microphone yet allowed for up/down tuning from the microphone—a great convenience for mobile operation.

The up/down-tuning function is actually already implemented in the 730. To use it, you must wire up your microphone switches as shown in Fig. 2, adding a 470-Ohm resistor for up/down control.

Cooling-Fan Control

The 730's cooling-fan circuit has two modes of operation. First, the fan runs at low speed at all times when in the transmit mode (push-to-talk operated, key down, or transmit switch depressed). Second, high-speed fan operation occurs when the heat-sink temperature exceeds approximately 75 degrees Celsius, a condition which triggers a thermal switch, causing the fan to run at high speed during both transmit and receive until the heat sink cools back down.

There really are times, however, when it is not necessary to have the fan running at all, such as during periods of QRP operation or whenever the transmit power or duty cycle is low. A switch can be installed that will allow you to bypass the fan in its low-speed mode. This will save battery power, eliminate unnecessary fan noise, and prolong fan life.

To provide a switch selection of fan operation on transmit but still leave the emergency mode of fan operation on overheat, simply lift one end of resistor R24 on the power-amplifier board and insert an SPST switch in series. A common mini-toggle switch will fit perfectly in the hole left in the rear-chassis panel if J5 (the memory backup jack) is removed. (This jack is not used anyway if you have done the Auto Memory Hold modification in this article.) My new switch is labeled "Fan Normal/QRP."

All of the modifications described in this article have been in my 730 for at least one year now, with absolutely no ill effects observed. I feel that they have significantly enhanced the capabilities of my mobile and CW operations. I hope you will find some of them to be useful improvements to your own 730 operations. Perhaps they will even help you get a step or two closer to having your own ultimately perfect rig for your own style of operation. ■

VIC RAMification: Part I

Here's how to turn 3 ICs and half an hour into 24K of extra VIC-20 memory.

Gary P. Brefini
12 Bailey Street
Foxboro MA 02035

Extra memory for a VIC-20 is a nice luxury, particularly when you have just finished editing a program but find that there are not quite enough memory locations for those DIM statements. This happened to me recently while preparing a VIC-20 Basic program to design yagi antennas. The solution is, naturally, more memory. But how? This article will show you how to completely fill the three 8K blocks of allocated RAM for the VIC-20 using only 3 ICs, 3 capacitors, a mother board, and some wire. Your construction effort will be worth it when your video monitor, after power-up, reads: "28159 BYTES FREE."

The *VIC-20 Programmer's Reference Guide*[1] explains the memory map for the VIC-20, so I will not go into detail about it. However, the VIC does have two areas in which to add additional memory: a 3K space from addresses \$0400 to \$0FFF and a 24K section from addresses \$2000 to \$7FFF. When the 24K expansion area is used, Basic cannot reside in the smaller 3K area. The memory expansion project in this article is designed to fill the larger 24K area.

The 24K area is composed of three contiguous 8K blocks. Block #1 resides in locations \$2000 to \$3FFF, block #2 resides in locations \$4000 to \$5FFF, and block #3 is located in memory at \$6000 to \$7FFF. Filling these locations gives the Basic programmer an additional 24K of usable Basic on top of the factory-installed memory of the VIC-20, which is 5K bytes. When the 24K memory is installed, the VIC's kernel program readjusts locations of various housekeeping routines, such as the screen buffer, so that a large contiguous area of available RAM is dedicated to the programmer.

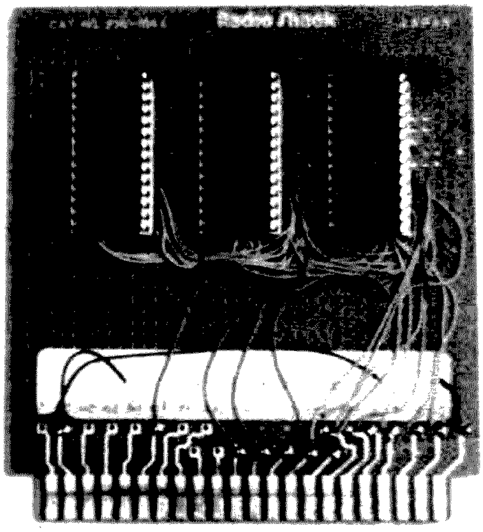


Photo A. Top view of the completed memory-expansion board.

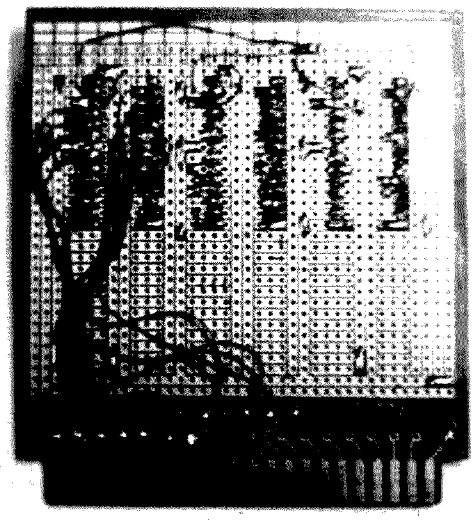


Photo B. Underneath the memory board. Point-to-point soldering was used in lieu of wire-wrapping.

Board Design

Any memory expansion for the VIC must be done via the 22/44-pin expansion port at the right rear of the keyboard case. This connector is an industry standard card-edge connection, so locating a mother board is no problem. I chose the Radio Shack 276-154A board. This is a 3-voltage-source plug-in board with a 22/24-pin card-edge connector.

The next step was the selection of the actual ICs to be used for the memory. I had previously built a 3K expander using 2114 RAM chips. These RAM chips are 4K-bit devices arranged as 1K of half bytes or nibbles. Each 1K byte of memory requires a pair of 2114s. It was a lot of point-to-point wiring for that 3K board. Granted, it was fun and only took 3 hours to build, but a 24K RAM board constructed out of 2114s would need 48 ICs! So I decided to look around at available high-density static RAM chips. I found that Hitachi makes a 64K-bit device (HM6264) arranged as 8K by 8 bytes. Perfect! All that is required is 3 of these beauties and my VIC would be fully populated with memory.

Fig. 1 shows the schematic for the 24K-byte RAM board that plugs directly into the expansion port. Using the HM6264 RAMs makes the interfacing to the port simple, since no additional bus buffering is required. That's due to the on-chip tristate buffers and the fact that each chip can be selected by lines already available at the VIC's port without decoding logic. Each chip draws only 40 milliamps, which is no problem for the VIC's built-in power supply.

The circuit is fairly straightforward. Each HM6264 IC has the address, data, and write-enable lines tied in parallel. Only the chip-select lines are uniquely connected to the card-edge connector. Note that there are two chip-select lines on each HM6264. Pin 20 is the inverted chip select and pin 26 is the non-inverted chip select.

Pin 26 is used if one desires a power-down operation. If not, pin 26 should be tied high to +5 volts. I chose the latter option. This leaves the inverted chip-select line, pin 20, of each HM6264 to be tied individu-

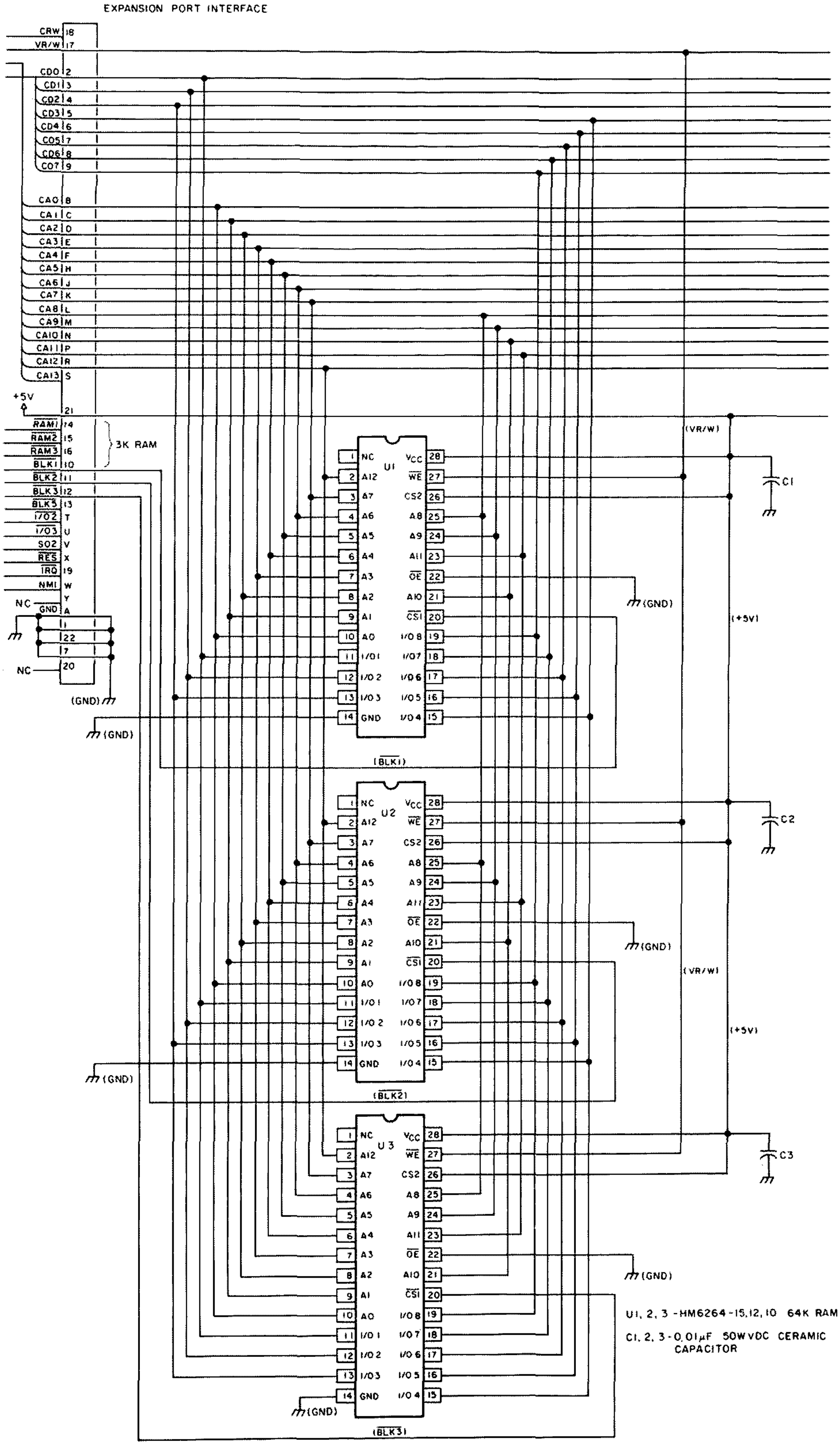
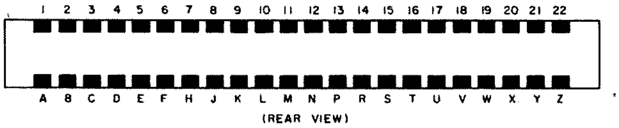


Fig. 1. Schematic of 24K RAM circuit.



Pin #	Type	Pin #	Type	Pin #	Type
1	GND	16	RAM3	K	CA7
2	CD0	17	VR/W	L	CA8
3	CD1	18	CR/W	M	CA9
4	CD2	19	IRQ	N	CA10
5	CD3	20	NC	P	CA11
6	CD4	21	+5V	R	CA12
7	CD5	22	GND	S	CA13
8	CD6	A	GND	T	I/02
9	CD7	B	CA0	U	I/03
10	BLK1	C	CA1	V	S02
11	BLK2	D	CA2	W	NMI
12	BLK3	E	CA3	X	RESET
13	BLK5	F	CA4	Y	NC
14	RAM1	H	CA5	Z	GND
15	RAM2	J	CA6		

Fig. 2. Memory-expansion port.

```
10 REM: 24K MEMORY DIAGNOSTIC ROUTINE
20 REM: G.P. BREFINI JUNE 1984
30 PRINT "♥"
40 PRINT "INPUT START ADDRESS IN ";"DECIMAL?": INPUT A1
50 PRINT " ": PRINT "INPUT END ADDRESS IN ";
60 PRINT "DECIMAL?": INPUT A2
70 FOR I=A1 TO A2
80   PRINT "POKING AT MEMORY ADD# ";"       ";I
90   POKE I,0
100 NEXT I
110 PRINT ">>>>>> END POKE <<<<<<"
120 SUM=0.0
130 FOR I=A1 TO A2
140   PRINT "PEEKING AT MEMORY ADD#";"       ";I
150   SUM=SUM+PEEK(I)
160   IF SUM <> 0 THEN 240
170 NEXT I
180 PRINT "CHECK SUM=";SUM
190 PRINT " "
200 PRINT "CHECKED ";A2-A1;"BYTES"
210 PRINT "OUT OF:"
220 PRINT "BYTES FREE "; FRE(0)
230 GOTO 260
240 PRINT "ERROR AT LOCATION #   ";I
250 PRINT ">>> CHECKSUM ERROR <<<"
260 END
```

Program listing. Memory diagnostic routine.

ally to the *BLK1, *BLK2, and *BLK3 signal lines of the VIC expansion port. (Note: the "*" preceding BLK1, BLK2, and BLK3 means the complement of BLK1, BLK2, BLK3.) I also tied the normally-inverted-output enables (*OE) to ground for simplicity. Each RAM is mounted in its own 28-pin socket with a .01-microfarad bypass capacitor tied to ground at pin 28 of each IC to eliminate any possible glitches.

Photos A and B illustrate that I like to solder rather than wire-wrap. My reason is that I do not own wire-wrap tools, but have a soldering iron, solder, hookup wire, and patience. Plus, for me, soldering is a kind of therapy which gives me time to pay attention to the connection I am making.

In Photo A you can see that I ran the address lines between the ICs at the top of the board and the data lines at the mid-portion. The data lines from the ICs were run on the top side (same side as ICs) along with the 3 chip-select lines. The address lines were run on the bottom side to the card edge.

It is important to study the sense of how the board plugs into the VIC's expansion port. The card-edge connections on the same side as the ICs (as in Photo A) are the VIC expansion-port pins 22 to 1, going left to right. If you flip the board over, keeping the card-edge connector closest to you (as in Photo B), the card-edge connectors run A to Z, going from left to right.

Fig. 2 is from the *VIC-20 Programmer's Reference Guide* and is a view of the actual 22/44-pin expansion slot from the back of the VIC. You should study Fig. 2 so that incorrect wiring of the board does not occur.

Board Testing

The final step is the testing of the RAM board. A large Basic program that successfully loads into memory is a good check that you wired the board correctly. You may not have developed such a large program working with only the 5K RAM installed at the factory. Instead, you may POKE $FFFF at several locations between $2000 and $7FFF. A PEEK at these same locations should return an $FFFF. If not, check your wiring for poor connections or shorts. It is also a good idea to use some emery cloth or very fine sandpaper (an ink eraser will do) on the tabs at the card-edge connector of your board. Remember to clean the card-edge contacts with a solvent, such as video or audio recording-head cleaner, to avoid foreign deposits that might jam the VIC's expansion slot.

I have included a listing of a very simple memory diagnostic routine (see program listing) which you can use to check your new 24K of RAM by POKEing and PEEKing into all or some of these locations. This program resides in the lower 5K of the factory-installed RAM of the VIC. If you let A1 equal 8192 (decimal) and A2 equal 32767 (decimal), then the routine checks all 24K locations by POKEing all zeros, then PEEKing and forming an all-zero checksum if the memory is operating correctly. It takes about a half-hour to check all 24K locations. You could just check a few sub-blocks over the 24K range if you are in a hurry.

The hardest task in building this board was in orienting the connections of the address lines and data lines on the board to the VIC's expansion-port signals. In addition, the HM6264 is a relatively new static RAM chip, and it is not as available as is the 2114. But as we all know, this situation will improve as time goes by. I have listed some suggested part sources along with a parts list at the end of this article.

Building this 24K RAM board will be a rewarding experience, especially when you need that extra memory! Good luck. ■

Parts List

3	HM6264P (150-, 120-, or 100-nanosecond access time), Jameco Electronics, 1355 Shoreway Road, Belmont CA 94002.
3	0.01-microfarad, 50-WV dc ceramic capacitor, Radio Shack 272-1065.
1	Plug-in Vectorboard® with 22/44-pin connector, Radio Shack 276-154A.

References

1. A. Finkel, N. Harris, P. Higginbottom, M. Tomczyk, *VIC-20 Programmer's Reference Guide*, Commodore Business Machines, Inc., and Howard W. Sams and Co., Inc., First Edition, 1982, pp. 124–125.
2. Joel Swank, "The Enhanced VIC-20; Part 2: Adding a 3K-Byte Memory Board," *Byte*, March, 1983.
3. Hitachi *IC Memory Data Book*, #M10, available from Hitachi America, Ltd., 1800 Bering Drive, San Jose CA 95112.

VIC RAMification: Part II

W6LOB fills the 3K gap of Part I with a quick piggyback RAM expansion.

John T. Cocking W6LOB
18812 Aspesi Drive
Saratoga CA 95070

How would like to see "6655 BYTES FREE" when you power up your unexpanded VIC-20? How would you like another 3072 bytes of Basic when you have added RAM expansion cartridges? Or how would you like another 3K bytes available for alternate screens and character sets? All three of these wishes can come true if you expand your VIC-20 internally.

By adding 3072 bytes of static RAM inside the VIC-20, we enlarge the "unexpanded" VIC, we provide additional memory accessible by the video interface chip (6560), and we can recover the 3K of RAM lost to Basic when expansion RAM is added to blocks one, two, and three.

Here, in summary form, are the steps we take to expand the VIC-20: Six 2114 low-power, 300-nanosecond static RAM chips are piggybacked on the on-board 2114 RAM chips. The chip-select signals for RAM1, RAM2, and RAM3 are rerouted from the expansion connector to the piggybacked RAM chips. These same chip-select signals are disconnected from the internal bus-control gate; the inputs left open are then tied high to plus five volts.

Theory of Operation

Expansion of the VIC-20 is external to the VIC-20. The microprocessor (6502) chip looks either outside to whatever is plugged into the expansion connector or inside to the video interface controller (6560), the VIAs (6522s) for keyboard, cassette, and other I/O, the on-board RAM, the character-generator ROM, and color memory. Note that the software ROMs are considered to be outside the VIC-20. The definition of inside is: Those devices which must be shared by the 6502 and the 6560 are "inside," those devices which concern only the 6502 are "outside."

The inside devices are isolated from the outside devices by three-state octal bus transceivers (74LS245s). The 6560 is a DMA (direct memory access) device. It must get at screen memory, color memory, and character memory while the 6502 is between clock cycles. The operation of the 6560 must not affect any expansion device. Similarly, any access the 6502 makes to an external device must not affect internal devices. In addition, the 6502 must be able to access internal devices (RAM, character memory, color memory) without causing bus contention, a fancy label for a data traffic jam. The bus transceiver is controlled by a 13-input NAND gate (74LS133). When the 6502 looks for external devices, address decoding delivers a low signal on one of

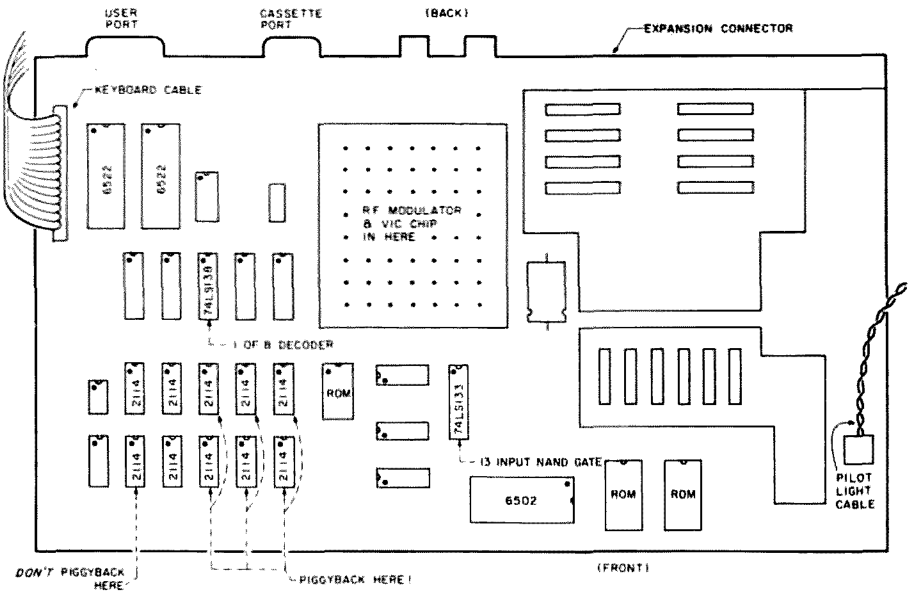


Fig. 1. Inside the VIC-20. Piggyback your new memory only where shown.

the 13 inputs to the 74LS133, causing its output to go high, which in turn puts the bus transceiver in a high-impedance (don't care) state, isolating the internal devices from the external data bus.

If we are to add memory inside, we must alter the VIC-20's definition of what is internal and what is external. The definition as it stands in an unmodified VIC-20 is: Any device whose address when decoded causes the 74LS133 to disable the bus transceiver is an external device. RAM1, RAM2, and RAM3 fit this definition. Our modification will add 3K of RAM as internal devices connected to the inside data bus. We must also redefine RAM1, RAM2, and RAM3 as internal devices. This means removing these signals from the expansion connector, removing them from the 74LS133, tying the now empty inputs high, and connecting the signals to the chip selects of our piggybacked RAM chips.

Materials and Tools

Here is a list of materials and tools we will need to perform our expansion of the VIC-20:

1) Six low-power, 300-ns 2114 static RAMS—JDR Microdevices, 1224 S. Bascom Avenue, San Jose CA 95128 carries the 2114L-3 at 8 for $13.45.
2) Wire-wrap wire.
3) Low-power soldering iron (30 Watts).
4) Extra-thin resin-core solder.
5) X-acto® knife with #11 blade.
6) Phillips screwdriver (to open up the VIC).
7) Volt-ohmmeter for continuity testing.
8) "Third-hand" vise.

In addition to the "hardware" items, there is also the software. We need a RAM test program, an alternate program load-address procedure, and a program to move the screen to our newly added memory. The two programs, RAMTEST (Program listing 1) and SCRMOV (Program listing 2) should be keyed in and saved before any hardware modification is undertaken. The alternate load-address procedure is executed in direct mode: POKE 43,1: POKE 44,16: POKE 4096,0: CLR.

	74LS138	74LS133	Expansion Connector
RAM1	pin 14	pin 4	pin 14
RAM2	pin 13	pin 5	pin 15
RAM3	pin 12	pin 6	pin 16

Table 1.

Procedure

1) Open up the VIC. There are three Phillips screws under the front edge of the VIC. Remove these and gently lift the front. The case is hinged at the back. Unplug the keyboard cable and the power-indicator lamp cord.

2) Locate the 2114s. You may have a VIC that uses 2K-by-8-bit RAM chips. If so, you will have to follow a different procedure. The procedure for both types of RAM chip is essentially the same, but only the 2114 chip is covered here. The 2114s are located in the lower-left corner of the board. They occur in two rows of five columns. Each column makes up one K of random access memory, so five columns equal five K.

3) Locate the chip-select gate (74LS138). The 74LS138 is located on the row of chips directly above the 2114s, in the upper row, third from the left. This chip is used as an address decoder and it provides chip-select signals (low) for each 1024-byte piece in the first 8192-byte block, which we could call BLK0. We are interested in the select lines for RAM1, RAM2, and RAM3. These signals travel to the expansion connector and also to the data-bus control chip, the 74LS133.

4) Locate the data-bus controller (74LS133). This chip is located in the middle of the board toward the front edge. Its function is to "tri-state" the data-bus transceiver chips whenever RAM1, RAM2, RAM3, or other off-board devices are accessed. Table 1 shows the connections of the chip-select signals. It would be wise to verify the specifications presented with a VOM.

5) Cut traces. This step is taken to stop the VIC from shutting off the data-bus transceiver when RAM1, RAM2, or RAM3 is accessed. To cut the traces, you must first remove the VIC board from the case bottom. There are eight Phillips machine screws to remove. There also may be a sheet of rf shielding taped to the bottom of the board. Remove this also. The traces which must be cut are at pins 4, 5, and 6 of the 74LS133 and pins 14, 15, and 16 at the expansion connector. Use the X-acto knife for this task.

Warning: When you turned the board over, the relative position of the pins changed. What was once on the left is now on the right. Be extra careful you are cutting the right traces. Also, make two cuts very close together and pry out the tiny chunk of copper—don't let it get under any of the chips. Wet the end of your little finger and remove the scrap from the board. Now, using a short piece of stripped wire-wrap wire, connect 74LS133 pins 4, 5, and 6 to 74LS133 pin 15. This will ensure that these three inputs will stay high (tied to plus five volts). Verify these new connections (and disconnections) with the VOM.

6) Install 2114s. This step takes the most time. We are going to piggyback six new 2114 RAM chips on top of six of the on-board 2114s. Whatever you do, do *not* use the left-most column of on-board 2114s for piggybacking. This is the lowest 1K block of RAM which is used by the operating system and the 6502 chip itself.

```
RAMTEST

10 PRINT "RAM TEST"
12 A=1024: B=4095
14 FOR I=A TO B
16      PV=85: GOSUB 24
18      PV=170: GOSUB 24
20 NEXT I
22 PRINT "TEST COMPLETE": END
24 POKE I,PV
26 IF PEEK(I)=PV THEN RETURN
28 PRINT "ERROR AT ADDR.";I
30 PRINT "DATA IS"; PEEK(I)
32 PRINT "SHOULD BE";PV
34 RETURN
```

Program listing 1.

```
SCRMOV

10 POKE 36869,144
12 POKE 648,4
14 FOR J=217 TO 228: POKE J,132: NEXT J
16 FOR J=229 TO 250: POKE J,133: NEXT J
18 POKE 43,0: POKE 44,6: POKE 1535,0
20 CLR:NEW
```

Program listing 2.

This area includes "page zero" and the processor stack in page one.

Use the middle three columns for piggybacking the new RAMs. Make sure that all the pins on the new 2114s are parallel. Test fit them on the on-board RAMs. The new chips should fit snugly without forcing. Now locate the chip select (pin 8) on each of the new 2114s and bend it outward until it is parallel to the circuit board. Put each chip into the third-hand vise and lightly tin the inside of each of the pins. Place the six new 2114s piggyback on the middle six on-board RAM chips.

Leave some breathing room between the on-board chip and its piggyback partner. Be sure you have oriented the new chips correctly. Pin 1 on these chips is generally indicated by a little dimple on the top of the chip. Pin 1 should be at the upper-left corner. Now, it is time to solder on the new chips. Tack-solder each to pins 1 and 10. Pin 10 is diagonally opposite pin 1. After each chip has been tacked on, briefly touch each pin's junction with the soldering iron. Check continuity of pin 1 of the new chip to pin 1 of an on-board chip without a piggyback partner. Do this for each pin with the exception of chip-select pin 8. Note any pins showing an open circuit. Use the tip of the X-acto knife to gently push and hold the pin while applying the soldering iron. Retest while applying the soldering iron. Retest the continuity with your VOM.

7) Prepare the chip-select lines which will connect each column (three of them) to one of the chip-select outputs of the 74LS138. The lines are made of three-inch lengths of wire-wrap wire. Strip one inch off one end and 1/8 inch off the other end. Tin the short end. The long end is connected to the chip-select pins, which are sticking out of the piggybacked RAM chips. Make a very small loop in the long stripped end right next to the insulation and slip it on the chip-select pin of the 2114 in the top row. Then, loop a turn around the chip-select pin of the 2114 directly below in the column. Solder the two connections. Now solder the short stripped-and-tinned end to pin 14 of the 74LS138. This column is now RAM1. Repeat for the next column, connecting its chip-select line to pin 13 of the 74LS138. This column becomes RAM2. The last column is connected to pin 12 of the 74LS138 and becomes RAM3. Check the continuity of these connections with the VOM. Now make a non-continuity check to ensure that the RAM1, RAM2, and RAM3 select lines are *not* connected to pins 4, 5, and 6, respectively, of the 74LS133.

8) This completes the hardware modifications. Before you put your VIC-20 back together and plug it in, here are some items you should check very carefully: First, are there any loose chunks of solder or bare wire lying around on the board? Second, are there any solder bridges between pins on the piggybacked RAM chips? The third point may sound silly. It isn't. I installed one of my 2114s backward. I found out during testing. So, be sure your 2114s are all pointing north. After your work passes this visual inspection, reinstall the board in the case bottom.

9) Button up the VIC. Tape the shield back. Be sure it is oriented correctly. Fasten the circuit board to the case bottom. Do not get the screws for mounting the board mixed up with those for fastening the case bottom to the case top (keyboard). Hinge-in the case top and connect the keyboard plug on the left and the power-on light plug on the right. For initial testing, you may want to leave the case top free or even off to the side a little. For final assembly, fasten the case top to the bottom with the three long screws.

Testing

For the initial "blue smoke" test, keep the expansion slot empty. Turn on the VIC. You should see "6655 BYTES FREE." If you do not, turn off the VIC immediately, reread the procedure, then open up the VIC again and check out each step, using the VOM where necessary. If you received the same old "3583 BYTES FREE," then the VIC is not aware of the RAM that has been added. The chip-select signals for RAM1, RAM2, and RAM3 may still be disabling the internal data bus. Verify that these signals are not connected to the 74LS133 and also that the RAM1, RAM2, and RAM3 inputs to the 74LS133 are connected to +5 V.

If you get nothing on your screen, then perhaps one of your 2114s is installed backwards. This has happened to me. I discovered my mistake by using my finger to see if any of the piggybacked chips were hotter than normal. One of them was very hot, and that is how I discovered the error. I replaced the backwards chip, correcting the malfunction. I learned two things from my error. First, it is necessary to check and double-check work of this kind. Second, the VIC-20 is quite sturdy; you don't have to be afraid of modifying your VIC.

Assuming that you now have received the power-up message of "6655 BYTES FREE," you should run a memory test on locations 0400h through 04FFFh. The RAMTEST program in Program listing 1 will serve, although if you have a better one, use it. To test the memory which you have just added, execute the alternate load-address procedure in direct mode, then load and run the RAMTEST program. The RAMTEST provided executes in approximately sixty-five seconds. Run the memory test more than once. If the test fails, the bad address will be displayed on the screen. From the address you can determine whether RAM1, RAM2, or RAM3 is bad. The display of the data at the failure point enables you to locate the malfunctioning chip. The failure is probably caused by an address line or a data line. Check out the connections to the chip which caused the memory-test failure. Also, check the chip-select line. Only after you have verified that all the connections are sound should you consider replacing the chip.

Moving the Screen

Here is where we recover the "lost" 3K of memory. Power down the VIC, plug in your memory expansion, power back up, and note the "BYTES FREE" message. In my case, it read "28159 BYTES FREE." Now load and run the SCRMOV program (Program listing 2). Clear the screen and execute ?FRE(0) in direct mode. My VIC-20 responded with 31230, which is 3071 bytes more than the power-up message. You should see a comparable increase in available memory. This added memory, unlike a plug-in 3K expansion, may also be used for alternate screens. One final warning: There are many programs which do *not* run with memory expansion. For these programs, you must execute the alternate load-address procedure before you load and run the program. ■

References

Nick Hampshire, *VIC Revealed*, Hayden Book Company, 1982.

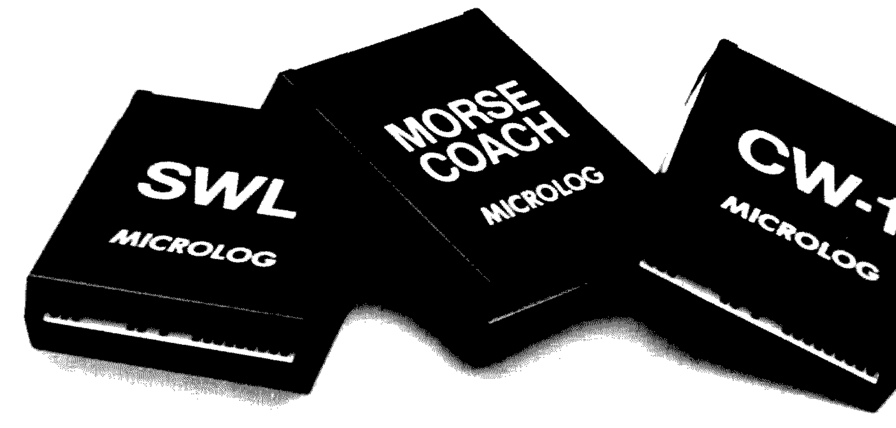
A. Finkel, N. Harris, P. Higginbottom, and M. Tomczyk, *VIC-20 Programmer's Reference Guide*, Commodore Business Machines, Inc., and Howard W. Sams and Co., Inc., 1982.

John Heilborn and Ran Talbott, *VIC-20 User Guide*, Osborne/McGraw-Hill, 1983.

Jim Butterfield, "Alternate Screens," *Compute!'s First Book of VIC*, Compute! Books, 1982.

LEARN

LISTEN SEND



A triad of C-64 cartridges to enhance your Radiobility

Listen to RTTY/CW with the SWL—Short Wave Listener

Microlog's answer for the short wave listener who doesn't need transmitting capability. The "SWL" is essentially the receive portion of the AIR-1 program in permanent ROM with both demodulators on board for dual tone RTTY and single tone Morse reception, housed in a small 3" × 2-1/2" × 7/8" enclosure. With speaker in/out and practice hand key jacks, it needs no other connection or power supply. Just plug it in and it's ready to run, as simple as that. Copies all speeds of RTTY baudot, ASCII to 300 baud, and Morse to 150 wpm. It has keyword or manual keyboard control of your printer and received buffer storage. Unshift on space, word wrap around, real time clock, and the famous AIR-1 style on screen tuning indicators mean you never have to take your eyes off the screen for perfect copy tuning. Surprise your favorite SWL with the Microlog "SWL" cartridge for the Commodore 64. Just $64.00 complete. Including connecting cable and demo cassette.

Learn Morse with the Expert Morse Coach

A complete Morse code tutor in a convenient plug-in cartridge for your Commodore "64". The Morse Coach means business. It's not a toy program or a simple random code generator. Originally developed jointly by Microlog and several government agencies experienced in Morse instruction, it's the quickest way to Morse proficiency. The method works—you start from absolutely no knowledge of Morse, progress through the alphanumeric symbols, and on to any speed desired. The "alphabet" part of the program introduces new characters and plots the progress on a bar-chart. The speed/test section correlates the input, analyzes mistakes and provides a printout of the analysis/test results on your Commodore printer. As a bonus, it also boosts typing skill. Every club involved in amateur radio instruction should have at least one Morse coach to use as a "loaner". Let's get the "VEX" program off to a flying start with the Microlog Morse coach at $49.95.

Send CW by Keyboard with the CW-1 Transmitter Module

Why buy a memory keyer when for $49.95 you can have a cartridge for your C-64 with all the CW transmit and memory capability of the AIR-1! Permanent ROM program and transmitter keying circuits give you perfect Morse up to 149 wpm. Will key tube type and solid state rigs. Huge 28000 character text buffer with split screen display for correcting pre transmit text. Eight programmable chain memories of 512 characters each, and two ID memories provide easy contest or rag-chew operation. Top line display shows transmit speed and real-time transmittable clock. Word/line mode and normal character mode for effortless operation. For learning, a random code generator and paced (long spacing) outputs are available on command. The direct output to a printer makes a great "letter writer" too.

Original AIR-1, $199.00 (with Amtor, $279.00). AIRDISK, $39.95. AIRDISK cartridge $59.95. Microlog Corporation, 18713 Mooney Drive, Gaithersburg, MD 20879 Tel: 301 258-8400

MICROLOG ✓51

INNOVATORS IN DIGITAL COMMUNICATION

✓ See List of Advertisers on page 80

Transistors: A Biased Approach

In Part II, we evaluate base current and gain and use this information to design a working transistor circuit.

Bob Myers KC0EW
413 Edgewood Drive
Loveland CO 80537

In Part I of this look at transistors, we covered some of the basics of how bipolar transistors behave and went through a simple analysis using only the fact that the base-to-emitter voltage drop is fairly constant. To wrap up this look at basic transistor operation, we now need to consider the effects of base current and beta on our calculations. Remember the two fundamental facts we discussed last time: first, that the drop from the base to emitter is constant (at about 0.7 V for a silicon transistor), and second, that the collector current is some multiple of the base current. The number that you multiply the base current by to figure the collector current is called beta (sometimes written as just the Greek letter, β), and that's what this article is all about.

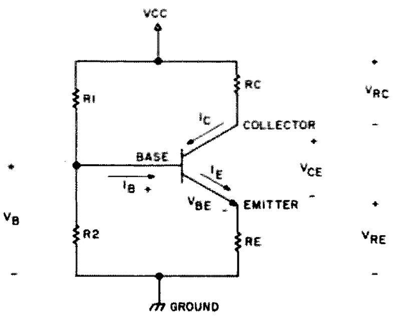


Fig. 1. An NPN transistor in a biasing network. Base, collector, and emitter currents (Ib, Ic, and Ie, respectively) are indicated by arrows. Voltages at the base (Vb), across the collector resistor (Vrc), the emitter resistor (Vre), and from collector to emitter (Vce) are also indicated.

Let's look again at the basic NPN transistor in a biasing network, just like we started the last time (Fig. 1). The arrows in this diagram represent the currents in each of the three leads of the transistor and show the directions in which we normally consider these currents to be flowing. (Note that the arrow on the emitter of the NPN symbol is pointing in the same direction as the emitter current—an easy way to remember it.) We still want to be able to set the collector voltage and current to some set of desired values, i.e., to "properly bias the transistor to a given dc operating point." Last time, we ignored beta and the base current and simply used the voltages around the circuit and the base-emitter drop to figure all the currents. But now, the situation gets a little more complicated. The emitter current is not the same as the base current—both the base and collector currents are shown flowing *in* to the transistor, and the emitter current is flowing *out*. The emitter current is the sum of the base and collector currents. So, if the collector current is beta times the base current, the emitter current must be "beta + 1" times the base current. Knowing the emitter current (and the drop across the emitter resistor) won't do a thing for us as far as getting the collector voltage and current unless we know beta.

Well, that seems like a simple enough problem. All we have to do is look at the spec sheet for the transistor we're using, plug the number for beta into our calculations, and we're done. Well, right now I'm looking at a spec sheet for the ever-popular 2N2222A, a typical general-purpose small-signal transistor. The beta for this part can be anywhere from 100 to 300—a 3-to-1 range! And not only could you expect a variation from part to part, but the beta of a given part will change with temperature, frequency, and a number of other conditions including, of all things, collector current! We're not going to be able to simply plug a number in and go—we don't know the number.

What we'll have to do is to figure out the real effect of beta and then work out some way to keep our design going for any beta within the possible range. Otherwise, a design that works with one part might not work with the next, or might not even work from day to day.

We'll work on figuring out the collector current as a function of the base voltage *and* beta. Once we have the collector current, the collector voltage is easy (it's just the supply voltage minus the drop across the collector resistor). Notice that this ignores any dc load on the collector other than the collector resistor—OK if we're ac-coupled to the next stage, but keep this in mind.

Well, even if the relation isn't as simple as it used to be, finding the emitter current and voltage will give us something. With the emitter current equal to "beta +1" times the base current, and the collector current simply beta times the base current, we could say that these two currents are related as $Ic = \beta/(\beta + 1) \times Ie$. The emitter current, thanks to Ohm's Law, still has to be the emitter voltage divided by the emitter resistance, or $Ie = Ve/Re$. We know the relation between collector and emitter currents, so we can write $Ic = \beta/(\beta + 1) \times (Ve/Re)$.

Aha! Looks like we now need to bring in our other piece of information—that the emitter voltage is 0.7 volts less than the base voltage. Doing this, we write $Ic = \beta/(\beta + 1) \times ((Vb - 0.7)/Re)$.* Whether it looks like it or not, we're a lot closer now to our goal. If we can get Vb in terms of the supply voltage and R1 and R2, we're done. But R1 and R2 *aren't* the simple divider they were last time—not all the current through R1 is making it to R2 since the base is taking some.

This complicates matters somewhat, but don't give up. We can simplify the situation by replacing the circuit to the left of the base (Vcc, R1, and R2) with an equivalent, as shown in Fig. 2. Here, Vth is the voltage that would have been produced by the R1-R2 divider if the base current hadn't been there. Rth is simply the parallel combination of R1 and R2. The "th" modifier comes from the fact that this is what's called a "Thevenin equivalent" circuit, named for the man who first described it. A little thought will convince you that this equivalent will perform just like the real circuit it replaces—increase the base current and the drop across Rth increases, lowering the base voltage. Using this equivalent, we can now write $Vb = Vth - (Ib \times Rth)$.

The base current, Ib, is just the collector current divided by beta, so we can write $Vb = Vth - ((Ic/\beta) \times Rth)$. This equation and the one marked with an * above have only one term between them that we can't either simply plug in or easily calculate—Ic, the collector current, which just happens to be what we're looking for. Pulling these two together and solving for Ic (and here I'll wave my algebraic magic wand and skip a few steps so we can get on with this) gives $Ic = (\beta \times (Vth - 0.7))/(Rth + (\beta + 1) \times Re)$.

This looks pretty formidable, but let's take a close look and see what it means. An increase in the number on the bottom $(Rth + (\beta + 1) \times Re)$ will reduce the collector current, and an increase in the number on top $(\beta \times (Vth - 0.7))$ will increase it. This just says that making Rth (R1 and R2 in parallel) bigger or making Re bigger will cause the collector current to go down. This is as expected—increasing Rth should decrease the base current; an increase in Re, for a given emitter voltage, must reduce the current in the emitter and the current in the collector. Similarly, increasing Vth (by raising Vcc or R2) should increase the base current, and so increase the collector current.

Notice that beta appears in both the numerator (upstairs part) and denominator (downstairs) of this expression. If it weren't for Rth down below, we might be able to ignore beta. For example, if beta were equal to 100, we'd have an expression with 100/101 in it—which is pretty darn close to one, and so it could be tossed out. But just maybe we can choose the values for the biasing network so that we don't care about beta—which is the whole idea.

Now that we have an expression for Ic, we can begin to try some designs and see how well they work for varying betas. Before we do this, let me give you a few basic rules of thumb that will usually make this job simpler. First, since we want to minimize the effect of beta on Vb, try to make the current through R1 considerably larger than the base current—say 10 to 100 times as big. We've talked about setting the collector voltage, but what we're usually going to be interested in is the voltage that the transistor sees from the collector to emitter (Vce). Transistor specs will always list a maximum allowable Vce, and we'll want to keep our designs running well within this spec. So, the last two rules deal with this voltage: First, the voltage across the emitter resistor (Ve) should be about the same as Vce. Second, the supply voltage, Vcc, should be around four times Vce (three to five is really OK). This will help keep Vce stable without being excessively large.

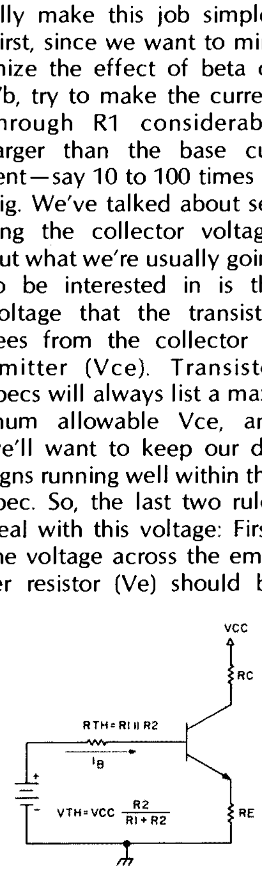


Fig. 2. The base biasing network is replaced by the "Thevenin equivalent" to simplify calculations.

With these rules in mind, we'll try a design. Let's go ahead and use the 2N2222A and try for, say, a 5-mA Ic with a 10-V Vce. Using the rules mentioned above, Vcc should be about 40 V and Ve should be equal to Vce at 10 V. With a 5-mA collector current and about the same in the emitter, the emitter resistor will be about 10 V/5 mA, or 2,000 Ohms. Similarly, the collector resistor will have to drop about 20 V, so it should be 20 V/.005 mA, or 4,000 Ohms. The base should be at about 10.7 volts (0.7 V higher than the emitter) and we want the current through R1 to be 10–100 times the base current. With the "worst" beta specified for a 2N2222A being about 100, the base current will be 5 mA/100 = 0.05 mA. We'll make the current in R1 about 20 times this, 1 mA. This gives a value for R1 of (40 V − 10.7 V)/1 mA, or 29.3k. R2 is then 10.7 V/(1 mA − 0.05 mA) = 11.3k.

We now have values for all resistors in the biasing circuit and Vcc. This is shown in Fig. 3. Now that the first pass design is finished, we'll plug these values into our expression for Ic and see how well we did. Rth is R1 and R2 in parallel, or 8.2k. Vth is just $Vcc \times R2/(R1 + R2)$, which is 11.1 V, and we'll use 100 for beta, as we did in the original design.

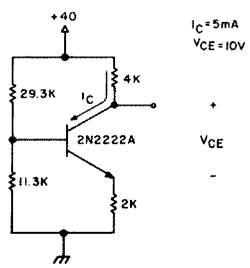


Fig. 3. The circuit designed in the example.

This gives Ic = (100 × (11.1 − 0.7))/(8.2k + (101 × 2k)) = 4.9 mA, and since Ve = 2k × (4.9 mA + 4.9 mA/100) = 9.9 V, and Vrc = 4k × 4.9 mA = 19.6 V, then Vce = 40 V − 19.6 V − 9.9 V = 10.5 V.

These values are pretty close to what we wanted, but let's see what happens with the other extreme for beta—which for the 2N2222A is about 300. Here, Ic = (300 × (11.1 − 0.7))/(8.2k + (301 × 2k)) = 5.1 mA, and Ve = 2k × (5.1 mA + 5.1 mA/300) = 10.2 V, Vrc = 4k × 5.1 mA = 20.4 V, Vce = 40 V − 20.4 V − 10.2 V = 9.4 V.

Again, these are close to our design goals. What's happening here—a three-to-one change in beta, and only a 5-6% change in the output? Look at Fig. 1 again. The emitter resistor is the key to the circuit's stability; as the output current goes up, so does the voltage across the emitter resistor. This forces the base voltage up (constant base-emitter drop, remember?), which in turn forces the base current, and hence the collector current, *down*.

The emitter resistor is acting to provide negative feedback to control the collector current. So, one way to make the circuit more tolerant of changes in beta is to increase the value of the emitter resistor. Another is to increase the current in R1 in proportion to the base current. This means making R1 and R2 smaller, which reduces Rth. As with everything, there are trade-offs to consider—increasing Re will raise the emitter voltage for a given emitter current, possibly requiring larger Vcc, etc. Decreasing R1 and R2 means that more current will be required by that side of the biasing network. There will also be other constraints placed on these component values by the signal gain and input/output impedances required of this stage, which is another whole area we haven't covered yet—ac performance.

While we're not yet to the point of doing single-stage amplifier design, these articles should have given you a better understanding of how bipolar transistors work and how to begin to design with them. I should mention one other thing, something which I've kept till last because it throws another variable into the works. Throughout this discussion, I've treated the base-to-emitter drop as a constant, at 0.7 V. Actually, it wanders around a bit, too; it can cover as much as a half-volt range or more. But fortunately, the transistor manufacturers will usually supply specs for Vbe for various base or collector currents. Simply choose the number that's right for your design and plug it in everywhere I've had "0.7 V" above. If you can't find a spec for this drop, go ahead and use 0.7 until you can find (or measure) a better number.

This two-part article has been concerned strictly with the dc performance of transistors. We haven't really looked into how they work as amplifiers or how to design for desired gains or input/output impedances. But we've come a long way toward a better understanding of these circuits already. The dc biasing of the transistor has to be right before anything else will work, so make sure that you understand everything we've discussed here. Then begin looking at some simple amplifier designs and how they work—check out some examples in the various handbooks and see if you can apply what you already know about how a transistor behaves to these circuits. And maybe in the near future, if you'd like to see it, I'll come back with another article or two on simple amplifier design. ■

Erik Fountain KA6IFQ
1432 W. Roberta Avenue
Fullerton CA 92633

Automate the FT-757

Ready for robot radio? An inexpensive micro is all that you need to computer-control your Yaesu.

Are you a ham who is thinking about buying (or just bought) a Yaesu FT-757 with the idea of computer-controlling it? If so, this article is for you. The design details of a simple interface are described. Also, some general program development information is given. A specific example using the Radio Shack MC-10 Micro Color Computer as a controller is shown. Finally, a program for the MC-10 which lets you send commands to the radio, remotely set frequency, and scan a large number of stored frequencies is included.

The FT-757 is a fully-synthesized HF transceiver and general-coverage receiver containing three microprocessors. A smaller package and a much simpler overall design is the result of this innovation. The main microprocessor, an MC-146805G, controls the synthesizer frequencies and permits functions like storing and retrieving frequencies from memory, band stepping, and dual vfo operation. These and other useful functions can be enabled by controls on the front panel.

A feature of particular interest is the interface connector on the rear panel of the radio. This connector accepts serial data from a personal computer and allows the operator to duplicate some functions under program control. It should be noted that the radio design does not permit complete remote control through the serial interface. Functions such as mode, sideband selection, and receive bandwidth can only be controlled manually at the front panel. However, the computer interface does provide an enhancement of the existing radio functions.

Any computer with an RS-232 serial interface capable of driving a printer can be used to control the radio. Fig. 1 shows the serial data format. Note that each data byte contains one start bit (logic 0), 8 data bits, and one or more stop bits (logic 1). It is sent at a data rate of 4800 bits per second. The levels of this signal are TTL-compatible which must be 0 to 0.3 volts for a logic 0, and 2.7 to 5.0 volts for a logic 1.

The standard RS-232 serial data output of a computer swings both positive and negative, and it exceeds the interface voltage limits of the radio. An adapter circuit must be provided between the radio and computer. RS-232 devices send a negative voltage level for a logic 1, so the adapter must also invert the data stream. Yaesu will sell an interface unit specifically intended for this function.

For those eager to try computer control, the circuit shown in Fig. 2 provides a low-cost method. An NPN transistor provides the necessary level translation and inversion. The resistor in series with the base and the diodes help isolate the computer from the radio. The radio has its own internal pull-up resistor to 5 volts, so the collector can connect directly to the radio serial input. No external power supply is required. The high base resistance and the use of the radio's internal power minimize the risk of damage to the microprocessor due to excessive voltage.

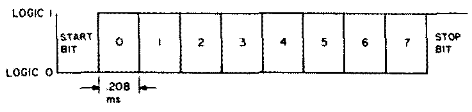


Fig. 1. Serial data format.

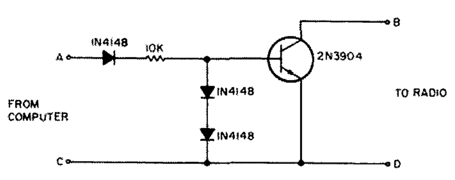


Fig. 2. RS-232 interface circuit.

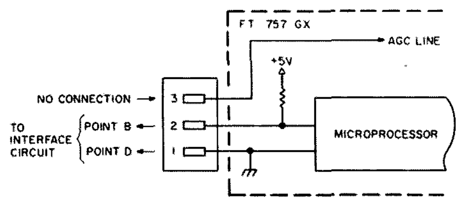


Fig. 3. Radio interface connection.

No.	Command	Data 1	2	3	4	5	Function
1	SPLIT	X	X	X	X	01	vfo-A/vfo-B SPLIT ON and OFF.
2	MR/VFO	X	X	X	X	02	Exchange operating freq. between memory and vfo.
3	V ► M	X	X	X	X	03	Write vfo data into memory.
4	D LOCK	X	X	X	X	04	Lock tuning dial.
5	VFO A/B	X	X	X	X	05	Exchange operation between vfos A and B.
6	M ► V	X	X	X	X	06	Write memory data into operating vfo.
7	500 UP	X	X	X	X	07	Step up 500 kHz (BAND UP).
8	500 DWN	X	X	X	X	08	Step down 500 kHz (BAND DOWN).
9	CLAR	X	X	X	X	09	Activate or deactivate clarifier.
10	Frequency set	①	②	③	④	10	Enter new operating frequency.
11	V ⇆ M	X	X	X	X	11	Exchange freq. data between vfo and memory.

Fig. 4. Command codes.

Construction is not critical, but care must be taken to prevent the circuit output (point B) from shorting to the input (point A) or serious damage to the radio may result. The circuit can be built into a small box or installed directly within the computer.

The completed circuit should be tested prior to connection to the radio. Connect point B to a 1000-Ohm resistor which in turn is connected to a +5-volt supply, and connect the negative supply lead to point D. Connect a 9-volt battery or similar voltage source between points A and C. When A is at +9 volts, B should be less than 0.2 volts, and when A is at −9 volts (reversing the battery), B should be at +5 volts.

The serial input can be found on the rear panel of the FT-757; it is labeled REMOTE. A special interface plug is available from Yaesu for connecting to this serial input. I recommend that you use this part, which can be obtained from your local Yaesu distributor, or write to Yaesu Electronics, PO Box 49, Paramount CA 90723, and ask for part number P1090234. The $1.91 cost includes shipping and handling. If you are unable to get this part, then a temporary plug can be made from a 14- or 16-pin, dual-inline IC socket. Just cut the socket in half (between the rows), trim one half until three adjacent pins remain, and carefully file the plastic until it fits into the serial input socket on the radio.

The connections to the radio are shown in Fig. 3. The center pin is the data line. The ground pin is the one directly below the letter R in the label REMOTE on the radio. The third pin should be left unconnected. This pin has a voltage derived from the radio's agc line. It could be used to measure signal strength.

With the interface installed the computer can send control data to the radio, but the format must be correct for the radio to interpret the commands. To explain how this process works, we must first understand how the computer sends information and what the radio is expecting to receive.

The numbers that a user would type into the computer to select a frequency are decimal (based on powers of ten). When a number is sent over the serial output using an LPRINT command, the number has been translated by the computer to its ASCII equivalent. ASCII (American Standard Code for Information Interchange) is a method of encoding numbers, letters, or symbols to provide compatibility between computers and peripheral devices like printers. The code is sent in binary (based on powers of two) and uses 7 bits, or 128 different numeric values for this representation.

The radio is designed to receive 11 different command codes, which are listed in Fig. 4. The table was taken from *CAT System Serial I/O Data Manual for the FT-757 GX,* available from Yaesu. One of these codes, the frequency-set command, is used to establish the radio frequency setting. Seven decimal digits (10 MHz to 10 Hz) are required to define each frequency. Inside the radio, BCD (Binary Coded Decimal), which uses 4 bits to represent a decimal digit, is the format used for the digits of the frequency setting.

Since each byte the computer sends contains 8 bits, the 7 frequency digits can be sent in 4 bytes. A fifth byte, the command, is required to tell the radio that the preceding 4 bytes represent a frequency. An example of a command setting the radio to 12.34567 MHz is shown in Fig. 5. The remaining 10 command codes require the same 5-byte format with the fifth byte being the command. The data in the preceding 4 bytes, which are not used in the command, is ignored by the radio.

To send the two BCD digits in one 8-bit byte requires a method to overcome the computer's tendency to put everything it sends in ASCII format. Fortunately, there is a command common to most computers that use Basic which will solve the problem. The CHR$(n) command is used when a programmer wants to specify the 8-bit serial data byte directly. The value, n, is a number between 0 and 255 and is the decimal equivalent of the 8-bit data byte.

The problem remaining is to get the computer to convert a seven-digit decimal frequency into the equivalent seven BCD values. Next, it must combine these values into four 8-bit bytes. After adding a fifth command byte, the computer must send these bytes to the radio at the proper data rate.

The problem is solved by first generating an algorithm (a sequence of steps) to turn a two-digit decimal number into an 8-bit data byte, formatted as two BCD digits. Generating algorithms can often be simplified by looking for patterns in numbers.

Fig. 6 shows how such a pattern appears here. The decimal frequency number, its corresponding binary byte in BCD format, and the

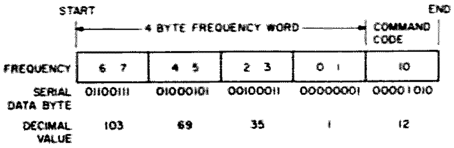


Fig. 5. Command setting frequency to 12.34567 MHz.

Two-Digit Decimal Number	8-Bit Serial Data Byte	Decimal Equivalent of Serial Data Byte
06	00000110	06
16	00010110	22 = 16 + 6
26	00100110	38 = 26 + 2*6
99	10011001	153 = 99 + 9*6
N	—	N + INT(N/10)*6

Fig. 6. BCD algorithm and data pattern.

Notes on the Use of the Interface Circuit

1. Insert the DIN plug into the MC-10 serial I/O socket.
2. Insert the flat connector into the remote socket of the FT-757.
3. Insert the tape into a tape player connected to the MC-10 and CLOAD.
4. Type RUN and enter.
5. The control codes are as follows:

S	= Split mode	F	= Enter frequency
M	= MR/vfo	E	= Save frequency just entered
>	= vfo => memory	/	= Manually scan stored frequencies
L	= Dial lock	H	= Automatically scan (HOP) stored frequencies
V	= vfo A/B	Spacebar	= Exit either scan mode
<	= Memory => vfo		
U	= Band step up		
D	= Band step down		
C	= Clarifier		
=	= Memory < = > vfo		

6. Pressing the above keys will execute the indicated function. When F is selected, the frequency must be typed in MHz, and the enter key pressed.
7. If a frequency is to be saved, press E after entering the frequency.
8. The stored frequencies can be manually scanned (press /) or automatically scanned (press H).

decimal equivalent of the binary byte are shown. This decimal equivalent is the value used in the CHR$ function to transmit the byte. The examples show that by taking the integer part of one-tenth the frequency, multiplying it by 6, and adding the product to the frequency, the decimal equivalent results. Thus, with this algorithm and use of the CHR$ function, a two-digit frequency can be sent as a two-digit BCD value.

The rest of the problem consists of breaking up the 7-digit frequency into 4 two-digit numbers. The Basic program listed in Fig. 7 performs this task by dividing the frequency by 10 and using the integer function a multiple number of times. The numbers are stored in an array which, after use of the CHR$ function, is sent out the serial port by using the LPRINT or similar command.

Commands not requiring a frequency value are handled similarly. The first four bytes sent can be any value since they are ignored by the radio. The fifth byte, however, must represent the desired command. The CHR$ function converts the decimal command value into the binary value needed by the radio. An LPRINT command is then used to send the 5 bytes to the radio, just as before.

A controller incorporating the circuitry and program techniques just discussed was developed using the Radio Shack MC-10 Micro Color Computer. Although many computers will work, this one was chosen for several reasons. It has the necessary RS-232 serial output already built in. The computer is small, it uses the Basic programming language, and it is very inexpensive.

The RS-232 output of the MC-10 connects to the input

```
10 F1=F/10
20 FOR J=1 TO 4
30 F2=INT(F1): F1=F1-F2
40 F2=F2+INT(F2/10)*6
50 A(J)=F2
60 F1=100*F1
70 NEXT J
80 LPRINT CHR$(A(4))+CHR$(A(3))
+CHR$(A(2))+CHR$(A(1))+CHR$(10);
```

Fig. 7. Program listing to create two-digit numbers.

of the adapter circuit. A 4-pin DIN plug (Radio Shack 274-007) must be used here. Connect pin 4 of the computer output to point A, and pin 3 to point C. With the output of the adapter circuit connected to the radio as described earlier, the interface between the computer and radio is complete.

A program listing for the MC-10 is shown in Fig. 8. This program is intended to be used without a continuously-connected TV monitor. A menu which lists the program functions is shown in the box (item 5) of notes. This menu can be cut out and taped to the MC-10 housing.

Carefully type the program into the MC-10, and CSAVE it to tape. Run the program. The functions are enabled by pressing the appropriate key. For example, to enable the dial lock, press L. The LOCK indicator on the radio display should be on. Pressing L a second time disables this function. To enter a frequency, press F, then type the desired frequency in megahertz and press ENTER. The frequency should now be visible on the radio display. The frequency just entered can be saved in the MC-10 by pressing E. All frequencies saved can be scanned manually by pressing /. They can be scanned

```
10 REM****757 CONTROL PROGRAM***
20 REM*****BY ERIK FOUNTAIN*****
30 DIM A(4),B(100): Z=0: N=1
40 FOR I=20224 TO 20243
50 READ D: POKE I,D
60 NEXT I
70 DATA 49,49,60,55,54,214,232
80 DATA 39,8,22,7,54,15,23,126
90 DATA 249,219,126,250,27
100 POKE 17032,126:POKE 17033,79
110 POKE 17034,0: POKE 16932,10
120 B$="SM)LV<UDCF=EH/"
130 A$=INKEY$
140 FOR I=1 TO 14
150 IF A$=MID$(B$,I,1) THEN 180
160 NEXT
170 GOTO 130
180 IF I>11 THEN 220
190 IF I=10 THEN 210
200 GOSUB 400: GOTO 130
210 M=1: GOSUB 400: GOTO 130
220 IF I=13 THEN 270
230 IF I=14 THEN 370
240 IF M<>1 THEN 130
250 M=0: Z=Z+1: B(Z)=F3
260 GOTO 130
270 FOR N=0 TO Z
280 F=B(N): I=10: GOSUB 410
290 FOR P=1 TO 1000: NEXT
300 IF INKEY$=CHR$(32) THEN 130
310 NEXT N
320 GOTO 270
330 N=1
340 A$=INKEY$
350 IF A$=CHR$(32) THEN 130
360 IF A$<>"/" THEN 340
370 F=B(N): I=10: GOSUB 410
380 N=N+1: IF N>Z THEN 330
390 GOTO 340
400 INPUT"F=";F: F3=F
410 F1=F/10+.0000005
420 FOR J=1 TO 4
430 F2=INT(F1): F1=F1-F2
440 F2=F2+INT(F2/10)*6
450 A(J)=F2
460 F1=100*F1
470 NEXT J
480 LPRINT CHR$(A(4))+CHR$(A(3))
+CHR$(A(2))+CHR$(A(1))+CHR$(I);
490 RETURN
```

Fig. 8. Program listing for the MC-10.

automatically by pressing H. To exit either scan mode, press the spacebar.

This program is simple. It is intended to serve as an elementary example. The techniques shown here can be used to develop more elaborate programs for individual applications. It can provide an opportunity for you to be really creative. The serial control capability makes the FT-757, which is already packed with features, even more appealing.

The MC-10 is the only computer I have tried as a controller, and I have experienced no significant radio frequency interference problems. Other computers may cause such interference, so verify that no problem exists before spending time writing programs.

Finally, I would like to thank W6XT and N6MN for their programming assistance and valuable suggestions. Good luck and happy programming. ■

Parts List

Qty	Part Number	Description	Approximate Price
Interface Circuit			
1	2N3904	Transistor	$ 0.49
3	1N4148	Diode	0.49
1	10k	Resistor	0.10
Controller			
1	MC-10	Computer	59.95
1	274-004	Connector	1.49

Both available from Radio Shack.

Peter H. Putman KT2B
84 Burnham Road
Morris Plains NJ 07950

That Glorious Gonset

With 300 Watts on 2 meters, the Gonset 972 thumbs its nose at solid state. Rebuild one and be heard!

You remember summertime. Hot weather. Ice cream. A dip in the pool. And lots of great propagation on two meters! You want to take advantage of some of the sporadic E, tropo, and aurora you've heard on 144 MHz, but your signal just isn't quite up to snuff.

Assuming you have fairly good antennas in place, the answer may be more power. And a good cheap way to get it is to convert a relic from the past to do the job for you. Many readers will recall the old Gonset company of California. Among their more forgettable products were the venerable Gooney Bird and Sidewinder series of transceivers for 50 MHz and 144 MHz. However, they did at one time make a line of amplifiers that were a great value and still are, if you can find them.

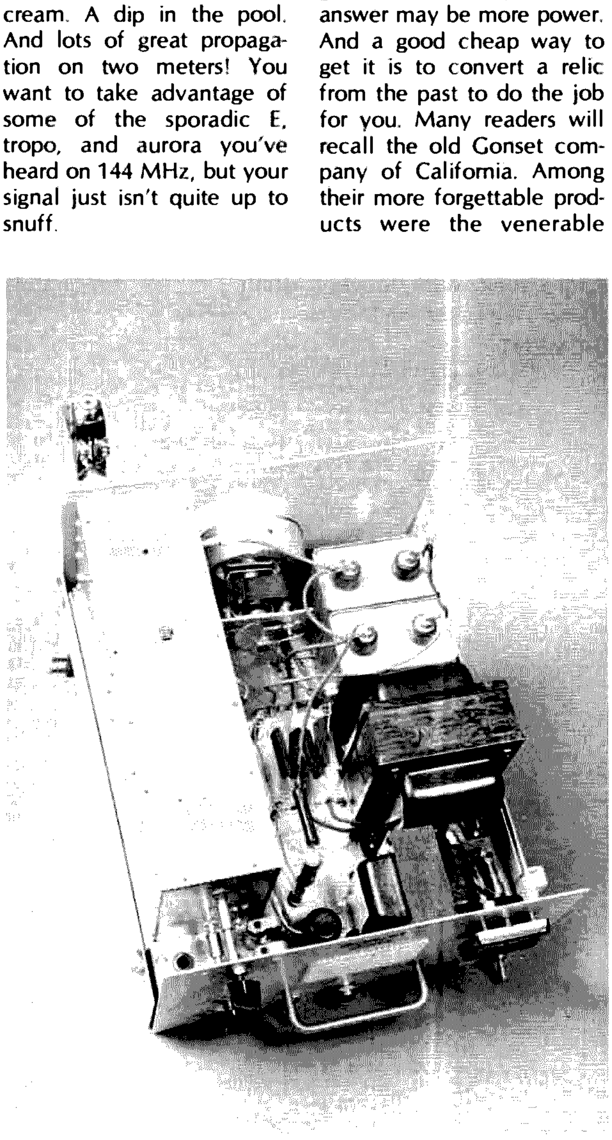


Photo A. Layout of converted 972 after construction is done.

If you are willing to do a little scrounging and soldering (and drill an occasional hole or two), then this conversion is for you. It won't cost much (about $125-$130 all told) and will yield an amplifier that will give you as much as 250-300 Watts of output for as little as 1-2 Watts of drive in the AB_1 mode. Sounds good? Read on!

The Gonset 903/972 series of amplifiers were sold to amateurs and commercial interests alike. 903s pop up at hamfests on occasion, but not cheaply, as they feature a built-in ac supply and will run as much as 400 Watts of output! The 972, however, is a beast of a different sort. Built originally as a 13.8-volt-dc version of the 903, it ran about 90 Watts of output using a 4X150A tube and found use as a mobile power amplifier for business-band use. In fact, many of these are still in service.

The 972, as it is configured, is a real current hog. Power requirements for full output are 13.8 V dc at 35 Amperes, so I wouldn't recommend using it as a mobile amplifier. But electrically it is essentially a 903 with a dc inverter to provide the necessary plate, screen, grid, and filament voltages.

I found my 972 at the Yonkers ARC auction in January, 1984. After studying the tables full of electronic goodies, I noticed a large grey chassis with a screened cover. After removing several nondescript items from on top, it was revealed to be the coveted 972A. This one looked like it had been bounced around a truck for some time, but mechanically it appeared to be fine. Since I had driven some distance and found what I was looking for (sort of), I persuaded the auctioneer to "bump" the order somewhat and put it up for bid.

A spirited round of bidding followed, whereupon the price was driven up to $80.00, at which point I prevailed. Shortly thereafter, while making settlement at the head table, my opponent came up, took a long look at the 972, and said to me, "Just what is that thing, anyway?" Oh, the fates are cruel.

Our group trundled home and I hastily removed the cover of my prize. All appeared OK and the tubes displayed markings and date codes circa 1974. A quick reference to the owner's manual (invaluable) told me what was to go. After locating the soldering iron and a pair of diagonal cutters, I

went to work. Refer to Figs. 1 and 2 to see the top and bottom layout of the 972 with the spring latch cover and bottom removed.

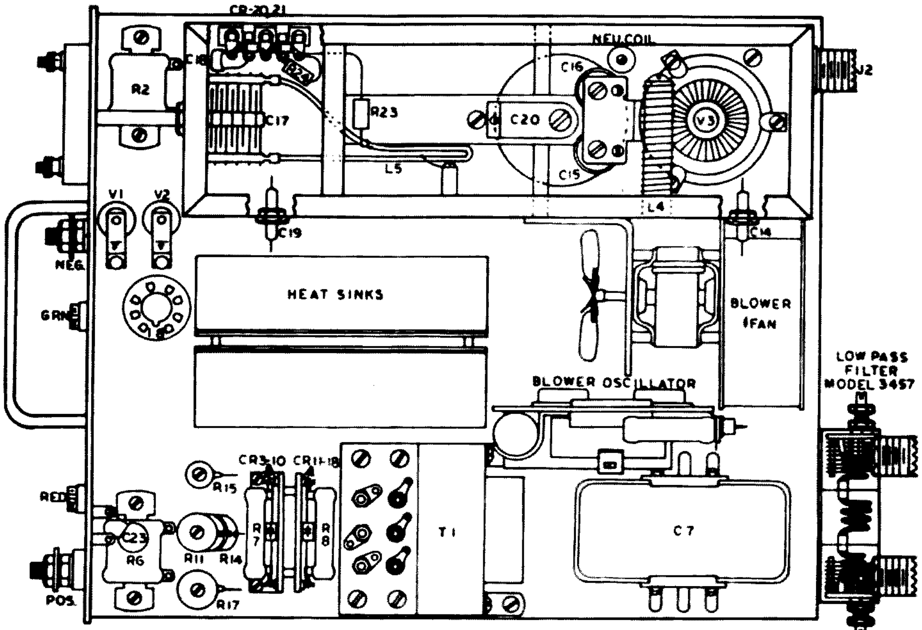
Assuming you've read this far, I am sure you have the appropriate tools in hand, so let's begin the conversion. The following items from the top of the chassis will have to be removed: C7, T1, CR3-10, CR11-18, R2, R7, R8, R6/C23, R11, R14, R15, and R17, as well as the assembly marked Heat Sinks. Also, remove the assembly marked Blower Oscillator but *not* the blower. Leave the rf chassis and 8-pin plug and socket intact, as well as the sockets for V1 and V2. Remove the tubes (2 × 0B2) as you'll have to replace them with 0A2s.

Save all the power resistors, as you will need some of them later. The rest of the components can be trashed. Also, remove the low-pass filter assembly from the rear panel. You won't need it and it won't handle the power you'll be running when you're finished. The unit was only put on for FCC certification purposes and the amplifier runs cleanly enough without it.

Now, it's time to tackle the chassis underside. Flip the unit over and remove the following components: K1, C1, C2, C8-9, C24-25, T2, PL1-2, R1, R5, CR2, R12-13, R9-10, R37, and CR19. Leave R25 and 26, as these are used in the rf power sensing circuit. R27 can be removed. Discard the other components except C8 and C9, which can be used in the bias supply. Also, retain the Bakelite™ support plate that they were on to hold the bias-supply parts.

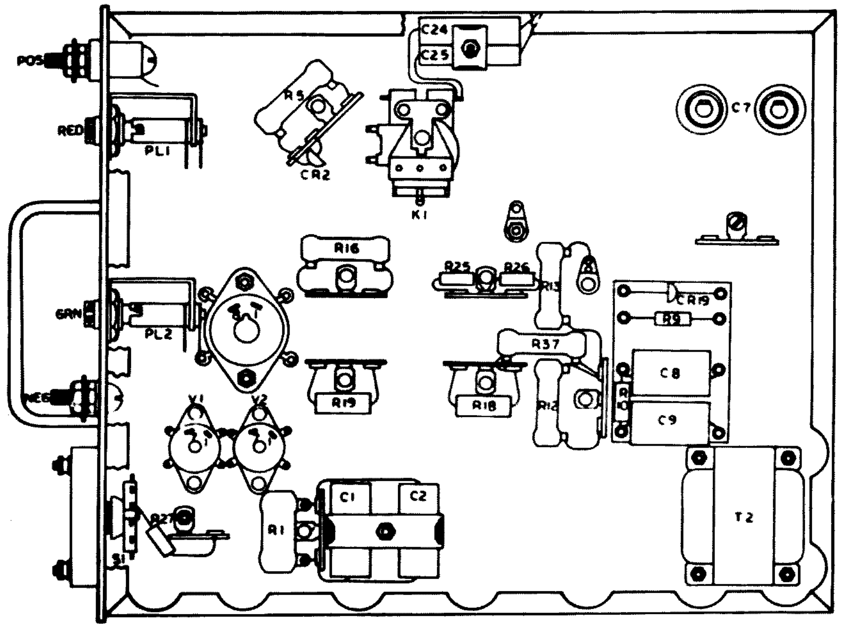
You will now need to locate a high-voltage plate transformer, preferably something on the order of 1200-1400 volts of output at about 350-400 milliamperes. You'll also need to locate a multi-tap power-supply transformer with the following voltages available: 350-400 volts at 50 milliamperes and 6.3 volts at 2.5 Amperes. If it also has a 5-volt winding, so much the better. Incidentally, this latter transformer is commonly found in smaller TV sets from about the same period. The last transformers you'll need are: 25.2 volts at 3 Amps (common Radio Shack item) and a transformer for the grid-bias supply. The latter can be either a 6.3-volt unit with its 117-V-ac primary connected backwards to the 5-volt winding on the multi-tap transformer, or a standard 117-V-ac primary/125-V-c-t secondary at 15 milliamperes.

Additional items required are filter capacitors for the HV supply, screen supply, and bias supply, HV diode rectifiers for the plate and screen, low-voltage rectifiers for the bias supply, various zener diodes, ballast and dropping resistors, indicators, fuse holders, switches, and a meter for the front



972A TOP VIEW

Fig. 1.



972A MAIN CHASSIS, BOTTOM VIEW

Fig. 2.

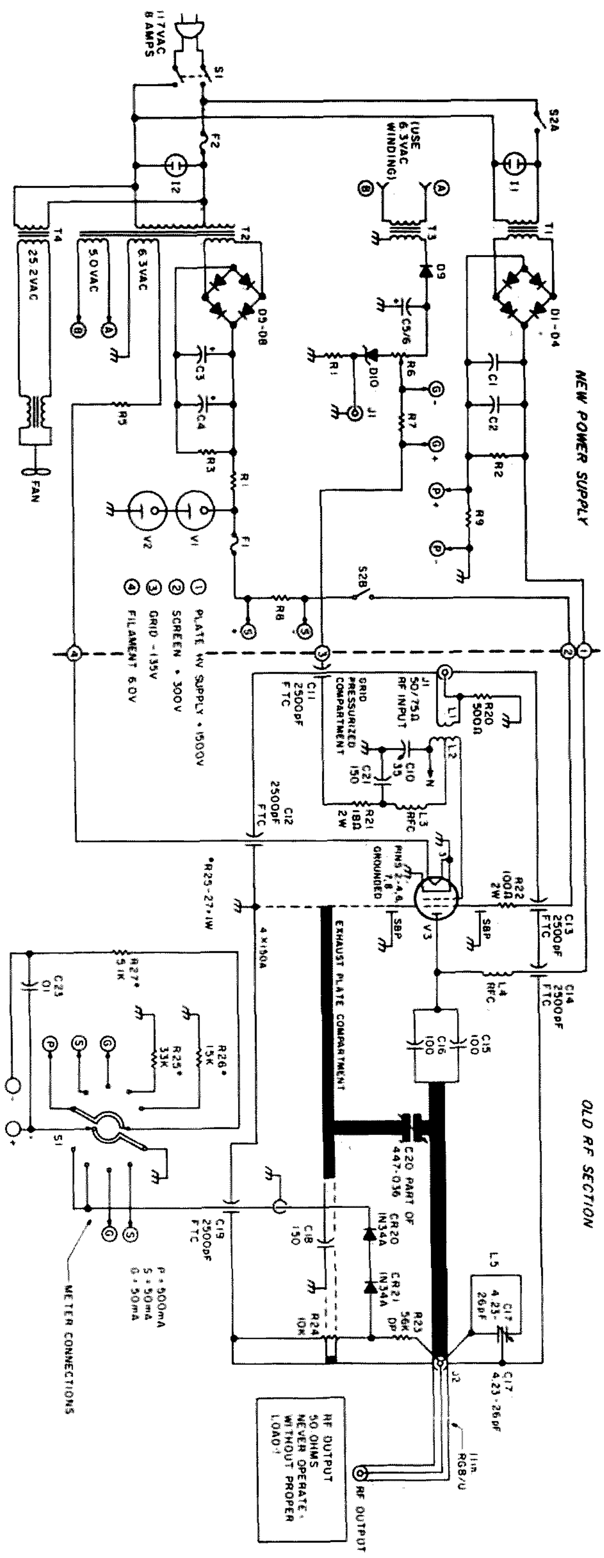


Fig. 3. Schematic.

panel. All of these items are itemized in the parts list, along with possible sources for each item. You may be able to come up with most of them from flea markets—perhaps even the same one where you picked up the 972 itself!

The first line of business is to install the HV supply components. When selecting the plate transformer, it would be a good idea to measure the space available on the chassis to accommodate what you have in mind. I won't give any firm guidelines here, but allow enough room for at least 2 high-voltage filter capacitors, the plate transformer, and the screen transformer (the multi-tap unit). Don't forget, the blower can't be moved. On my particular conversion, I also mounted the high-voltage rectifier stack on the top of the chassis (refer to Photo A to see the new top chassis layout). You should be able to arrange all the components with little trouble. On my particular version, I am using two 6-μF/2000-volt filter capacitors for the plate supply filter. The original transformer shorted out after a month and the replacement just made it between the capacitors and the multi-tap transformer. If you plan this carefully, you might be able to use a lot of the existing mounting holes on the chassis.

As was mentioned earlier, you should try to locate a plate transformer that will give you about 1200-1400 volts of output at about 300-350-400 milliamperes. The center tap isn't necessary, as you will be using a full-wave bridge-rectifier assembly, thereby increasing your plate voltage at the capacitor terminals to about 1500-1750 V dc, which is plenty. The 4X150A is rated for a maximum of 2000 V dc on the plate and, although you can run higher voltages, the tube will last a lot longer with reduced voltages.

These transformers aren't hard to find. I located one as part of a surplus Lambda regulated supply ($15.00) from a scrap dealer nearby. That particular chassis also yielded several good filter caps, sockets, power resistors, and switches. Fair Radio Sales in Lima, Ohio, is an excellent source for the transformer. As a matter of fact, they can probably supply most of the parts needed for the conversion, and a copy of their latest catalog would be most helpful.

Once you have mounted the plate supply, filter capacitors, and rectifier assembly, you should now mount the multi-tap transformer for your screen and filament voltages. I located mine just behind the front panel, but forgot to allow enough clearance for the meter, so it sticks out from the panel a bit. Oh, well! Locating the multi-tap transformer behind and just to the right of the screen mesh in the panel is an excellent location, mainly because the holes have already been drilled to pass the various leads through to the underside of the chassis! (How lazy can you get?) It is a simple matter to then use an existing terminal strip (which you've already stripped of components) to mount the full-wave bridge circuit for the screen supply (should yield about 350-400 volts); the filament leads will make it to the 8-pin socket without any trouble. This socket feeds the various voltages (except plate) to the 4X150A; such as screen, bias, filament, and also a return that carries sampled rf voltages for the power output meter.

Assuming you now have the multi-tap transformer working, the next step is to wire up and test the two supplies (plate and screen). You should pick up some HV test-probe wire (5-kV insulation, #18 stranded) for hookups on the plate. This is a common item and most electronics supply houses have it on the shelf. The balance of your hookups can be made with #22 for everything except the filament and blower connections. It would also be a good idea to procure a premolded, 3-conductor, #16 ac power cord with plug and bare ends (about 4-5 feet). Or, you can buy the wire and plug at an

electrical supply house for a modest cost.

Wire the plate supply as shown in the schematic (Fig. 3). Keep the leads short and retain the connector that goes to the HV-bypass feedthrough capacitor on the rf deck. Wire both capacitors in parallel but don't ground them as yet. Also, don't ground the — lead on the full-wave bridge! Connect the — sides of the filter caps and the — of the full-wave bridge together. You will also have to construct a bleeder assembly for the supply to improve regulation and to discharge the capacitors when not in use. Using the long 4-40 screws that held up the original bleeder assembly, salvage the 100k, 20-W and 25k, 25-W resistors that were previously stripped from the chassis. Configure a series resistance using the two of 125k Ohms and connect across the high-voltage + and — terminals (we're still above ground here). This will result in a bleeder current of 10–15 milliamperes, depending on your actual plate voltage. You'll need a dissipation of about 20 Watts total in the resistors and you have 45 available, so you are all set.

The next step is to either find, make up, or buy a .3-Ohm, 2-Watt resistor for your meter shunt. These are not uncommon at hamfests and you can string together different values to make it up. This then goes from your — connection (capacitors, full-wave bridge, and bleeders) to ground. This ground return path is at a low potential voltage, which makes it a very safe place to put a meter in the circuit to measure plate current. With the indicated shunt and about 1600 volts on the plate, the meter reads about 500 mA full scale. We'll get to the meter hookups later.

Test your supply by applying ac to the primary and using a Simpson 260 or equivalent meter with a 5-kV range. Look for correct plate voltage, then cut the power and verify that the bleeders are doing their job. Plate voltage should drop to zero in about 10 seconds. If all is well, you're ready to wire up the screen-voltage supply. Locate the windings desired (in my case, it was a 700-V-c-t unit, so I used one side and the center tap for 350 volts) and wire up the screen full-wave bridge. This can be done on an adjacent terminal strip under the chassis, or you can mount a new one. You'll need to locate two 40-μF, 450-V-dc electrolytics for the filter capacitors. Again, these are common items at hamfests. Whatever you use, the desired filtering is about 75–90 μF at 450 V dc.

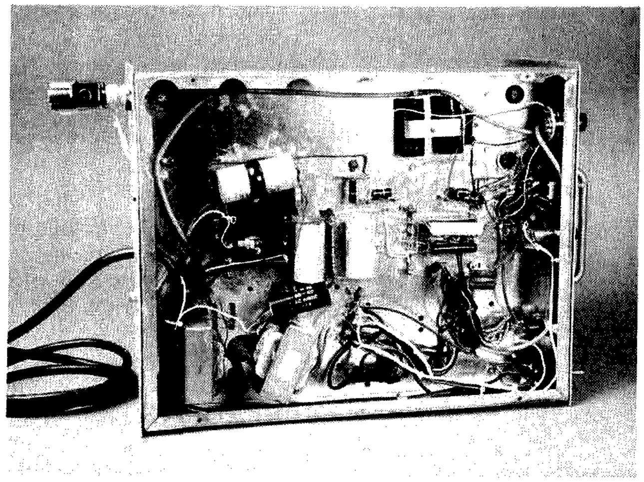


Photo B. Bottom view of the 972 with all final wiring in place.

Once this is done, you will have to configure the resistors: first, a dropping resistor for the regulator tubes. Simple calculations will yield the value needed: In my case, the output of the full-wave bridge with filter capacitors was about 435 volts. The maximum screen current on the 4X150A is 30 milliamperes, and the VR tubes (2 × 0A2) don't want to see more than 300 volts. The required drop is 435 − 300 = 135 volts/.030 = 4500 Ohms. Assuming normal use of the amplifier in class AB_1, chances are you won't exceed 20–25 milliamperes of screen current (unless you're driving the living daylights out of the tube) and one of the 5000-Ohm, 10-Watt resistors you stripped from the chassis will fit the bill perfectly. Your screen dissipation will be on the order of 3–4 Watts, so the 10-W rating is more than enough.

Now that you have dropped the voltage to the VR tubes, you'll also need to make up a screen bleeder. The guiding factor is that you want the screen supply to dissipate as fast or faster than the plate supply; otherwise, you'll pop the screens on the tube. I've also used a fuse here for extra protection—more on that shortly.

What kind of bleeder current do you need? Well, not much! The screen of the tube doesn't draw much to begin with, so the bleeder current ought to be on the order of about 5–10 milliamperes. Let's do some calculations: 300 volts/.010 mA = 30k Ohms. Some experimentation is in order here to determine the time constant, and rather than use math, I just tried several different values until the satisfactory current was reached, especially in relation to plate-discharge current. This value is close to what I actually used, which is about 33k Ohms. At this level, all you need is a 2-Watt resistor.

Make sure that the VR tubes are the last piece of the chain that goes to pin 3 on the octal socket. This is the most critical supply in the amplifier and it must be filtered and regulated extremely well for the amplifier to behave itself in a linear mode. If you want extra protection, such as if the plate supply fails, install a 1/10-Amp AGC fuse (*not* a slow-blow) in series with the screen-voltage line. This will prevent tube blowouts.

Once you have established that the screen and plate supplies are up and running, the next step is to tackle the bias supply. If you have located the 117-V-ac/6.3-V-ac filament transformer, simply hook up the 6.3-V-ac leads to the 5-V-ac winding on the multi-tap. This will yield about 95–100 volts from the now-backwards primary winding. A single diode is sufficient for this supply, as it doesn't draw much current at all and regulation is not a problem. You'll see about 120–130 volts at the output, but here's the catch: You must hook up the diode reversed, since we need negative bias! No sweat here, as the cathode (banded) end goes to one side of the transformer, with the other transformer lead grounded. The output is taken from the anode side of the diode and a 40-μF, 250-V-dc capacitor from the salvaged parts is connected backwards from it to ground —minus to the anode, plus to ground. Next, locate or buy a 5k, 5-Watt potentiometer, a 33-volt, 5-Watt zener, and a 1k, 2-Watt resistor. This is your bias network and should be connected as per the schematic.

When the key line at J1 is shorted, the 1k resistor is taken out of the line, thereby allowing the zener to do its thing and provide an adjustable range of about 50–120 volts dc. Removing the ground raises the standby voltage back to about 135 or so, putting the tube in hard cutoff. Mount the components on the Bakelite board that was rescued ear-

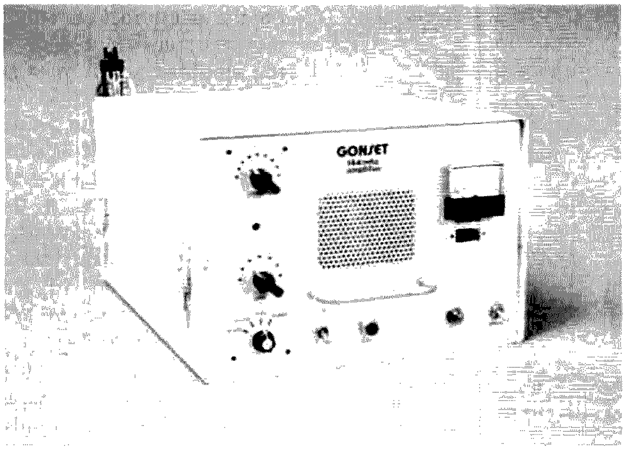


Photo C. The finished conversion with new lettering and a new paint job.

lier from the garbage and locate the bias-adjustment pot in a convenient location. I placed mine behind the filter caps inside the chassis to prevent accidental readjustment.

Note: If you chose the more conventional 117-V-ac/125-V-ac transformer, simply hook it up to your ac source and wire as before on the secondary. Your voltage range will be greater when adjusted and will sit at about 150-160 volts when on standby.

Verify that your supply will give you from −130 to −50 volts when J1 is grounded and R1 is adjusted. It should be a smooth adjustment and be stable when set. Where you set this pot will determine your class of operation. For example, a setting of −100 to −90 volts will put you in class C and the tube will need more drive for a given power output. This is appropriate for FM use only. Dropping the voltage to about −60 to −50 volts will put you in about class AB, where the idling plate current will be close to 80-100 milliamperes, and you'll need only about 1-2 Watts of drive for full power output.

OK, let's step back and inspect our work. The plate supply is now up and running. The screen and grid-bias supplies are also behaving as intended. You're almost done, believe it or not!

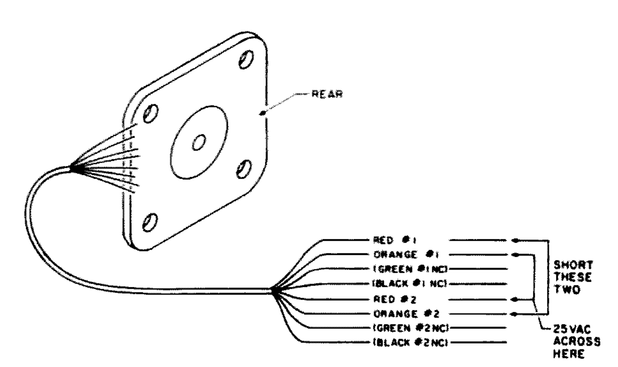


Fig. 4. Wiring diagram for modified blower. Of the eight wires, don't use either set of black or green wires. You'll need to determine which are the correct pairs by shorting one of the red wires to one of the orange wires and connecting 25 volts across the other two. If the blower won't turn, try the other red wire to the same orange wire and change 25-volt connections accordingly.

The next step is an easy one. You'll have to drop the filament voltage to the 4X150A to exactly 6.0 volts, as per Eimac's ratings. To do that, you need to know the filament current requirements (2.1 Amperes), and using simple math we find that 6.3 − 6.0 = .3 volts need to be dropped. Also, .3 volts/2.1 Amps = .14 Ohms. (2.1 × 2.1) × .14 = 6.1 Watts. So, you'll need a .14-Ohm, 6-Watt resistor? Well, my past experience has shown that the average .1-Ohm, 10-Watt resistor will fill the bill, yielding a filament voltage around 6.08 volts. For the intermittent use the tube will get, you're not shortening its life by any drastic amount, or even any appreciable amount! So, go ahead and use a .1-Ohm, 10-Watt resistor. These always show up in surplus houses and flea markets for a song. (I bought 5 at Dayton for 10¢ apiece.) Run the wire from this resistor to pin 8 on the octal socket and ground the other side of the filament lead for the return. If you haven't done so already, also hook up the grid bias to pin 2 of the octal socket.

If you want to use the multimeter switch and meter to also measure grid and screen current (and who doesn't?), you'll need to dig up or buy a couple of 3.3-Ohm, 2-Watt resistors. When the meter leads are across these resistors (in series with the screen and grid supplies), the meter scale reads about 30 mA full scale, which is perfect. Use one resistor for each supply. You can use existing terminal strips to secure the resistors, which should be installed right before the voltage goes to the octal socket.

By now, the bottom of your supply should be looking something like Photo B. Notice the neat layout and extensive use of cable ties and dressed leads. This makes troubleshooting a lot easier.

The next step is to install the new blower supply. This is nothing more than a Radio Shack 25.2-V-c-t, 6-Amp transformer. You'll have to wire the blower very carefully, however, as it was designed to run from a flip-flop supply that is nowhere near 60 cycles. The trick is to find the red and orange enameled wires and wire them in a series-parallel arrangement, as shown in Fig. 4. I fried another transformer by not doing this, as the current demands became excessive.

At this point, it would be a good idea to check all of your wiring. You should have plate, screen, grid, and filament voltages both in position and working correctly. The blower should also come up to speed and the transformer may run a little warm, but that's it! Again, refer to Photo B for the final layout. You may have to jockey the blower transformer around a bit to find the best compromise to get at the leads (which are quite long) and clear the other components. Take your time and be neat. Mark your wires well for later identification when hooking up the switches and lamps.

Now, the fun part begins. You are ready to install the switches and indicator lamps on the front panel, the fuse holder for the ac mains, a power cord on the back, and a jack for switching the bias control when in standby. It might be a good idea to consider sanding and repainting the chassis (see Photos C and D). If you are so inclined, you can also reletter all of the controls with transfer type and then spray the panels with a clear finish, like Krylon, for protection. Chances are if your 972 looks anything like mine did when I picked it up, it'll need a paint job.

It's time to do the front panel! One item I didn't scrimp on was a meter. Calectro makes a fine unit with a front-panel scale of 0-1 mA (catalog #D1-1012). It retails for about $15.00 and

Parts List

Plate Supply			
T1	117-V-ac primary, 1200–1400-V at 300-mA secondary	Fair Radio	
D1–D4	1N5408 type, 3 A, 1000 piv	Jameco	3/$1.29
C1–C2	Either three 4 uF at 20000 V dc	Fair Radio	4.00
	or one 12 uF at 2000 V dc	Fair Radio	12.00
R2	Bleeder—from 972 parts		
Screen Supply			
T2	117-V-ac primary, 700 V c-t at 50 mA 6.3 V at 3.5 A 5.0 V at 2.0 A	Fair Radio	5.95
D5–D8	1N4007 type, 1 A, 1000 piv	Jameco	10/1.29
C3–C4	50 uF, 350 V, axial	Fair Radio	.65
V1–V2	0A2 regulator tubes	Fair Radio	2.50
R3	Bleeder—from 972 parts		
R1	Dropping resistor—from 972 parts		
F1	Fuse, 1/10 A, 250 V, AGC	jobber/flea market	
Grid-Bias Supply			
T3	117-V-ac primary, 6.3-V secondary (hook up backwards to 5-V winding on T2)	Fair Radio	
D9	1N4004 type, 1 A, 400 piv	Jameco	12/1.29
C5–C6	From 972 parts		
D10	33-volt, 5-Watt zener (ECG or HEP)	jobber/flea market	
R4	1000-Ohm, 2-Watt carbon	jobber/flea market	
J1	RCA female chassis mount jack	Radio Shack	
Miscellaneous			
F2	Fuse, 8 A, 250 V (AGC-8 or MDL-8)		
M1	0–1-mA miniature panel meter (Calectro D1-1012)	jobber/flea market	
R5	.1-Ohm, 10-Watt resistor	Fair Radio	
R6	5k-Ohm, 2-Watt potentiometer	Jameco	
R7–R8	3.3-Ohm, 2-Watt resistors	Jameco	
R9	.3-Ohm, 2-Watt resistor	Fair Radio	
S1–S2	DPST switches, 8-A, 125-V-ac rating	Fair Radio	
I1–I2	NE-51-type indicator lamps, or preassembled 120-V-ac indicator assemblies	Jameco	
T4	117-V-ac primary, 25.2-V secondary	Radio Shack 273-1512	5.99
	Fuse holder (2)	Jameco	
	Ac cord and plug	jobber/flea market	
	Shaft couplings (2) and extensions	Fair Radio	
	Knobs, 1/4" (3)	Radio Shack	

Note: Prices and sources for some parts are not specific due to widespread availability, both surplus through Fair Radio and at flea markets. You should have little trouble finding what you need. For a free copy of Fair Radio's latest catalog, write Fair Radio Sales, PO Box 1105, Lima OH 45802.

is available in most electronics parts stores. With the shunts called for, it will give you the current ranges desired—0–500 mA for plate current and 0–30 mA for screen and grid current. If you're clever, you might find a way to mount it to cover the two terminal-strip knockouts. If you're lazy (like me), you can mount it above the Meter callout and leave the other hole blank. The leads that went to the terminal strip now go right to the meter. I ran all new shielded two-conductor cables to all sampling points and the meter itself. *Caution*: Check the polarity on the grid-current resistor, otherwise the pointer will go off scale reversed and possibly damage the movement.

Eimac tells us that 4X150As last longer if the filament voltage is allowed to come up without plate and screen voltages for about 3 minutes. To facilitate this and solve the tricky problem of bringing the plate and screen voltages up at the same time, I wired up a Plate switch on the front panel. This is nothing more than a DPST switch, one side of which controls the plate primary supply and the other of which cuts off the screen voltage right before the octal socket. If you place the switch as I did, you'll find that it lines up perfectly with the socket. An indicator light can be placed across the primary to show plate power is "up."

A good place for the ac mains fuse is right behind the meter on the top chassis. I used a clip-in-type fuse holder. If it blows, the cover can be quickly removed to gain access. Make this a 8–10-Amp MDL slow-blow for the current surge when the plate capacitors charge up. Wire your primary ac switch to bring up the grid-bias supply, filament voltages, and blower. Install an NE-51-type indicator across the transformer primary. If you are using a multi-tap transformer, wire its primary in parallel with the blower. This will bring up the grid supply, blower, filament, and screen, but the screen won't be in the circuit until you throw the plate switch.

Now you are ready to test the tube! You'll need a couple of voltmeters capable of reading 0–250 V dc and 0–2000 V dc. Connect the minus lead of the first to the bias line and ground the positive lead. Using high-voltage probes, *carefully* connect the positive lead of the second meter to the capacitor terminals and the negative lead to the minus side of the supply—*not ground*. Connect the HV-to-rf-compartment plug and plug in the octal plug. If you haven't done so, remove the screws that hold the rf compartment cover down. *Be careful—there is plenty of high voltage present!*

With the 4X150A in the socket and seated, turn the ac power on. Wait three minutes for the tube to warm up. Then, turn the plate supply on. You should be seeing about 1500–1700 volts on the plate and −135 to −150 volts on the grid. (You can also verify the 300 volts on the screen if need be, but the 0A2s should be glowing purple at this point.) With the bias-adjust control at its maximum resistance, ground J1. You should see somewhat of a drop in the grid voltage. While keeping J1 grounded, adjust R1 for about 100 milliamperes of plate current. Then, remove the ground from J1, and the plate current should drop to zero.

Again, ground the key line and verify that the plate current is back at about 100 milliamperes idling. If so, you have now set the tube to run in class AB_1—linear. The blower should be forcing a little warm air around the tube chimney. At this point you are running about 150 Watts dissipation (not power). If the above instructions check out, you're

ready to drive the tube and make power.

Note: If at this point the idling current still reads zero or very low, you may either have a bad tube or insufficient screen voltage getting to the tube. Check all connections carefully.

Connect your exciter (preferably 1-2 Watts—an HT is fine for tests) to the input connector on the back using a short length of cable. Connect either a 300-Watt dummy load or an antenna to the output jack on the back. Turn the plate switch on and key your rig or exciter. Using a dummy load, peak first the grid and then the plate-load controls on the front panel for maximum output with minimum grid and plate current. On most of the 972s, you will also have to tune the plate capacitor for resonance. This is a screw next to the tube inside the plate compartment. *Caution: This screw has plate voltage on it. Be careful!* Use a noninductive tuning tool to make the adjustment. In most cases, once you set this screw, you can make excursions across 2 MHz or so without an appreciable loss in power.

Carefully tune plate and grid for maximum output. You'll find that in AB_1 it will take only about 1-2 Watts to give 250-300 Watts of output power. Not bad, eh? That's close to 20 dB of gain, and think of what your 16-dB-gain antenna can do with that! If you prefer to run more drive power, simply set the idling current lower to about 50 mA, and it will take more drive (5-10 Watts) to achieve full output. What is full output? The 4X150A is rated at about 250 Watts maximum dissipation and peak current of 400 mA in SSB operation. Keeping the current down to 300-350 mA is a good idea, and you'll still be making lots of power.

The 4CX250B can be substituted with equally effective results. The only difference is that 4X150As are frequently available at flea markets for as low as $5.00 each, used, while good used 4CX250Bs generally run more than $15.00 each. You'll also find the spectral purity of this amplifier is excellent, making it ideal for repeater use. It'll sit all day and run 100 Watts without breathing hard!

You can obtain shaft couplings and extensions at flea markets to bring the plate-load and grid-tuning controls out to knobs on the front panel as I did. Or, you can just make the adjustments with a screwdriver, as they won't drift much. The key line to J1 can be hooked up to any radio with an external-amplifier keying jack. If you prefer, the circuit in Fig. 5 shows a simple rf sniffer using a Darlington transistor to switch a relay and establish bias. Additionally, if you have a Dow-key relay for the antenna line, you can hook it to the output and use the spare contacts to set the bias. Simply run the line from J1 to the relay instead and ground the closure contact. 12 V dc for the relay can be obtained from a diode off the tap on the blower transformer (sneaky, eh what!) and the jack on the rear panel can be used now to create the ground return for the relay operating voltage. This is the method I use, with an ICOM IC-740 driving an MMT 144-28 into the amplifier. The ICOM has an RCA jack that will key on transmit.

And there you have it! A 300-Watt, tube-type VHF amplifier for a nominal sum and some weekend work. If this doesn't get you on 144-MHz aurora, I don't know what will! If you have any questions about the amplifier when building it, send along an SASE for the reply, and I'll try to help out.

I would like to thank Steve Katz WB2WIK, who was most helpful with the conversion and convinced me to write this article, Mike Crawford WA2VUN, who punched the front panel at his shop, and my wife, Gayle KA9ESB, who sees all these "boxes" disappearing into the basement and doesn't give it a second thought. ■

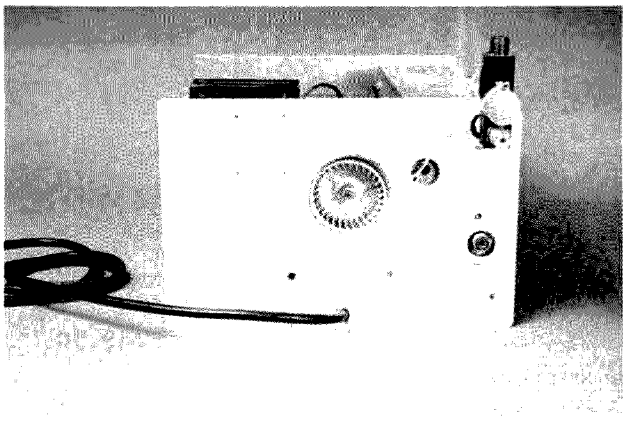


Photo D. Rear view of the completed unit after repainting. Note the position of the rf keying jack.

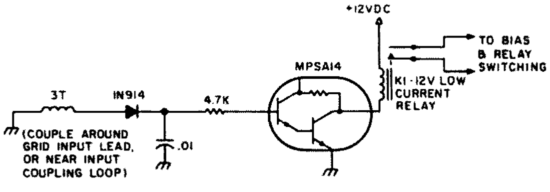


Fig. 5. Rf sniffer circuit—for keying with any radio using sensed rf.

H. H. Hunter W8TYX
1106 Carolyn Avenue
Columbus OH 43224

A Space-Saver Seven Megger

Stuffing full-wave 40m loops into tiny places is W8TYX's specialty. We finally got him to tell us how he does it.

When my only antenna, a roof-mounted vertical for 7 MHz, failed during the winter, I was not able to repair it because of the cold weather. I needed a replacement, but no trees, towers, or tall buildings were available for supports. After some experimentation I arrived at a (more or less) horizontal loop antenna which has performed surprisingly well.

Fig. 1 shows the general layout of the loop antenna. It is a closed loop with a total electrical length of about one wavelength at 7 MHz. I used no. 20 copper wire because that is what I had; the size of the wire is not important.

The loop begins under the house eaves about 8 feet above the ground and continues to the corner of the house about 24 feet away. The loop continues from the corner of the house to the corner of the garage, a distance of about 24 feet. The corner of the garage is about 7 feet above the ground. From there the loop continues to the peak of the garage roof, a distance of about 11 feet where it reaches its highest point, about 11 feet above the ground. The loop then continues to the far corner of the garage, a distance of 19 feet, descending to a height of about 7 feet.

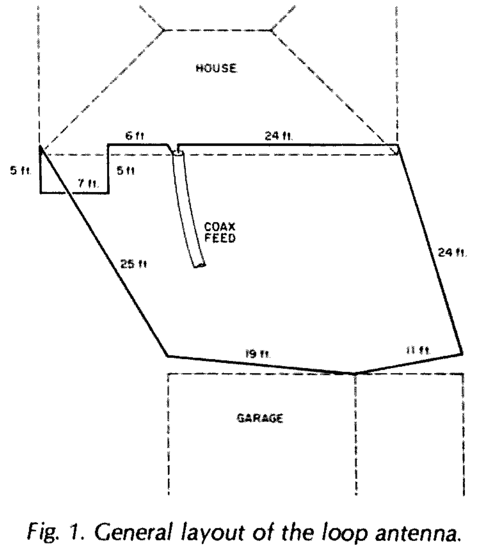


Fig. 1. General layout of the loop antenna.

From there the loop goes to the eaves under another corner of the house, a distance of about 25 feet; the height here is about 8 feet. The loop then goes vertically down the side of the house about 5 feet. The purpose of this "jog" in the loop is to add length and make the antenna resonant at the desired frequency in the 7-MHz band. The loop then goes horizontally for a distance of about 7 feet, then more or less vertically back up to the eaves, and then horizontally for a distance of 6 feet back to the starting point.

The loop is fed at the starting point with RG-8 coaxial cable. One end of the loop is connected to the center conductor of the coaxial cable and the other end of the loop is connected to the shield.

The jog in the loop, described above, was not in the original version of the antenna. It was added after measurements with a noise bridge showed that the resonant frequency of the antenna was too high. The dimensions cited above were not "designed." Rather, I used the space and the supports which were available and then adjusted the overall length of the loop to make it resonant at the desired frequency near the low end of the 40-meter band.

If you build a similar antenna, use what you have in the way of space and supports and start with a total length of the loop equal to about one wavelength at the desired operating fre-

quency. A wavelength is given by the expression: $\lambda = 935/f$ where λ = wavelength (feet) and f = frequency (megahertz).

After you have erected the loop with the calculated total length, measure its resonant frequency using a grid-dip meter, an swr bridge, or a noise bridge. The calculated length is just a starting point. The resonant frequency of the antenna will be affected by the presence of nearby objects and its height above ground. Adjust the length of the loop to obtain the desired resonant frequency. An increase in length will decrease the resonant frequency, while a decrease in length will increase the resonant frequency.

Fig. 2 shows the vswr (voltage-standing-wave ratio) of the completed loop as a function of frequency for the 40-meter band. These measurements were made at the far end of a 50-foot length of RG-8 coaxial cable which was connected to the loop. The bandwidth for a reasonable vswr covers most of the CW portion of the 40-meter band. I do not have equipment to measure the impedance of the antenna, but the minimum vswr of 1.2 to 1 indicates that the driving impedance at resonance is a reasonable match for the 50-Ohm impedance of the coaxial feedline. Measurements of my (repaired) vertical antenna are shown for comparison.

A horizontal loop antenna radiates most of its energy at high angles with respect to the earth. So this is not a low-angle DX antenna. However, on 7 MHz it performed well on short hops out to a few hundred miles. The best DX I worked using this antenna was OK1APV in Czechoslovakia, but band conditions were good that night. It consistently performed well with stations out to about 500 miles; beyond that distance my vertical antenna did better.

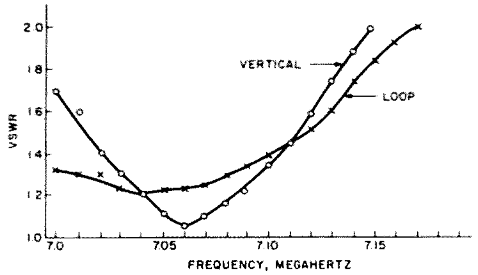


Fig. 2. The vswr of the 7-MHz loop.

After the 10-MHz band opened, I shortened the overall length of the loop and made it resonant for that band. Fig. 3 shows the vswr of that loop across the 30-meter band; it is less than 1.2 to 1 over the entire band. I have worked VK3AGW twice using this simple antenna.

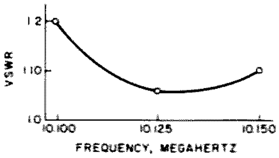


Fig. 3. The vswr of the 10-MHz loop.

If you are stuck without an antenna or just want to try a different type of antenna, give this horizontal loop a try. It's not a world-beater for DX, but it is simple, easy to put up and adjust, and works reasonably well. That's a good combination. ■

✓ See List of Advertisers on page 80

David L. Oliver W9ODK
Route 2, Box 75A
Shevlin MN 56676

Shoestring RTTY

Build a commercial-quality computer interface for under $30.

When I decided to put my computer on the air and see what was happening on the RTTY scene, I set out to design and build a simple interface that would provide accurate decoding of received Teletype® and CW signals and allow the computer to key either the FSK or the CW input of the transceiver. I wanted to spend less money but, hopefully, get as much performance as buying a commercially made interface.

My first attempt was a very simple circuit using phase-locked-loop tone decoders to detect the mark and space tones. It had post-detection filtering and one bandpass filter on the input. It performed perfectly under "laboratory conditions," but in the real world of amateur-radio bands, the printout was often rather confusing. Something better was obviously needed.

Having heard that active filters were hard to design, build, and adjust, I was reluctant to begin design of a filter-type decoder. I rather cautiously breadboarded a basic state-variable filter circuit using the TL-084 bi-FET op amp and found that it worked perfectly on the first try, didn't oscillate or ring, and provided a very high Q at the design frequency which came out exactly where the formulas had predicted. Since that was the hard part of the design, the rest went smoothly and I was on the air with just a few days work and only about $30 spent out of the ham-radio budget.

Fig. 1 shows the circuit diagram of the interface. I feel it is about as simple and straightforward as possible without compromising performance. All switching is done with single-pole switches and no tuning is required after initial setup. The switching arrangement lends itself well to push-button operation and a very modern look is possible using the switch assembly shown in the accompanying photographs.

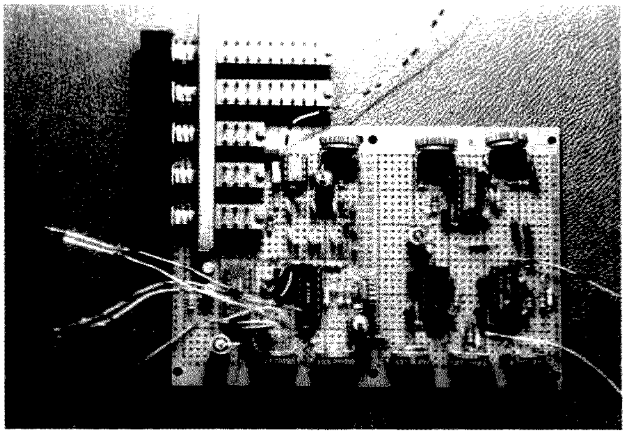
How It Works

The audio signal enters at J1 and goes through a bandpass filter (BPF) centered at 2210 Hz. This filter is used only for 170-Hz-shift RTTY and can be switched out with S1 for wider shifts.

The signal then goes to U1, a 741 op amp, which with S2 closed operates as a limiter, producing a square-wave output at the frequency of the strongest signal in the passband. With S1 open, the op amp operates as a conventional amplifier that does not clip the signal at normal volume levels. Normal operation is in the FM or limiting mode, which provides better performance on weak or noisy signals. The AM mode can prove useful if there are two signals close together and the tendency of the limiter to capture the stronger signal is not desirable.

The output of U1 is then attenuated slightly by the voltage divider consisting of R4 and R5 so as not to overload the following filter stages. It is fed to the inputs of three BPFs consisting of a 2125-Hz filter for the mark tone and 2295- and 2550-Hz filters for the space tones corresponding to 170- and 425-Hz shifts, respectively. The reason for choosing these shifts is that my primary interests are in ham operation on the HF bands (nearly all 170-Hz shift) and commercial shortwave teletype (usually 425-Hz shift). Any shift can be copied in the single-tone mode (selected by S4). Since 850-Hz shift

The completed interface. The round object above the switches is the tuning meter.


The circuit board with the switch assembly attached.

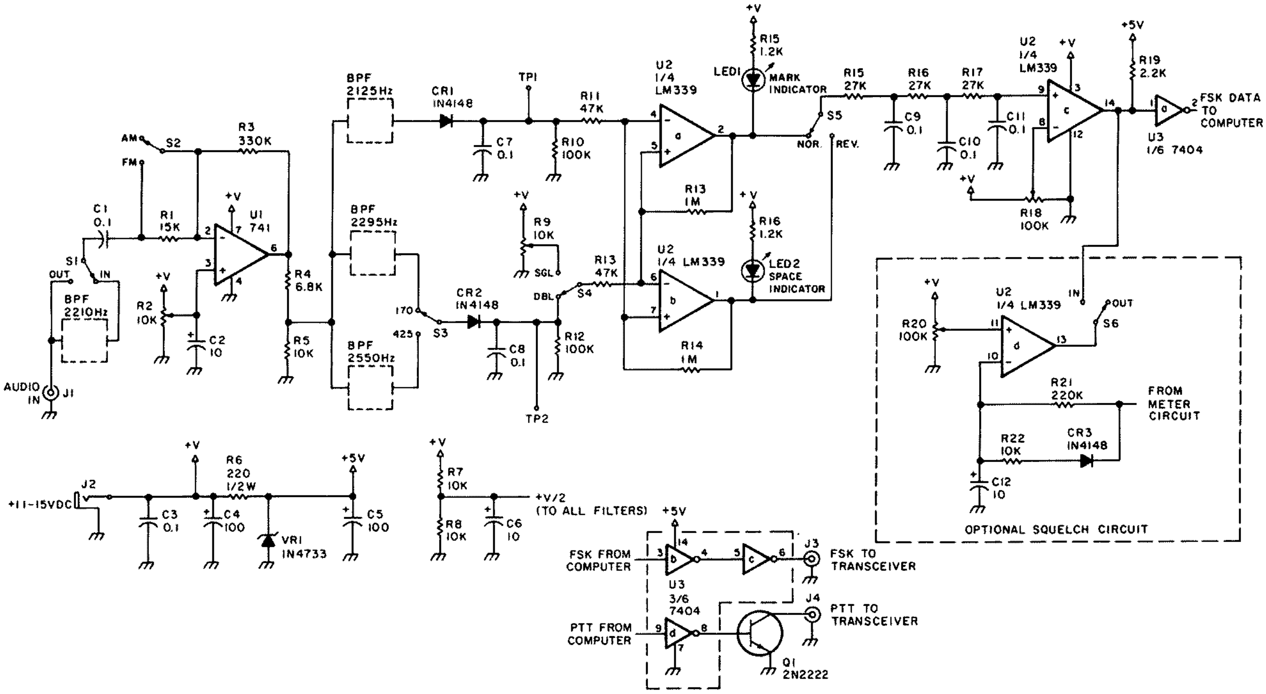


Fig. 1. Computer interface.

is used mostly on VHF where signals are strong and clear, I would recommend using single-tone detection rather than adding another filter. A 2975-Hz BPF could be substituted for the 2550-Hz filter, or all three shifts could be implemented by using a three-position switch at S3. After the BPF stages, CR1 and CR2 half-wave rectify the output signals of the filters and, in conjunction with C7, C8, R10, and R12, provide dc levels corresponding to the strengths of the mark and space tones.

Two sections of U2, an LM339 quad comparator, are connected so that when the mark tone is present, the output of U2a goes low and U2b goes high. The presence of the space tone produces the opposite condition. The comparators will respond to relatively small differences in the detector dc levels, allowing for maximum signal-to-noise ratio. Since the difference between the levels of the two signals is detected rather than comparing each one to a set level, very weak and noisy signals can be decoded fairly accurately; i.e., the noise level coming out of each filter is assumed to be the same, so any difference must be due to the frequency changes in the FSK signal.

The outputs of U2a and U2b drive the LED mark and space indicators. S5 selects normal or reverse shift and sends the appropriate output to the three-pole passive post-detection filter consisting of R15–R17 and C9–C11. U2c squares the output of the filter and converts it to a TTL level, which is inverted by one section of a 7404 hex inverter, U3a. A TTL signal which is high on mark and low on space is now ready to be sent to the computer.

U3b and U3c simply buffer the computer FSK signal to be sent to the FSK input of the transceiver. U3d and Q1 provide a push-to-talk output so the computer can automatically switch the transceiver to the transmit mode.

The power supply requires a source of regulated dc power, typically 13.8 volts, which is available in most ham stations. Since the current required at 5 volts is very small, a simple zener-diode regulator is used. The voltage divider consisting of R7 and R8 provides a reference for all the active filter circuits. It is important that all the filters be supplied with the same reference because this ensures that the mark and space detec-

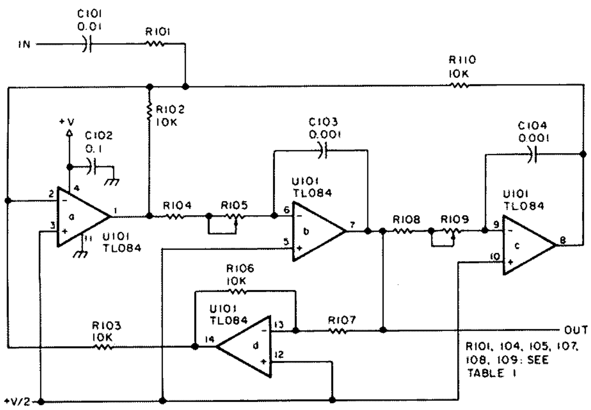


Fig. 2. Bandpass filter.

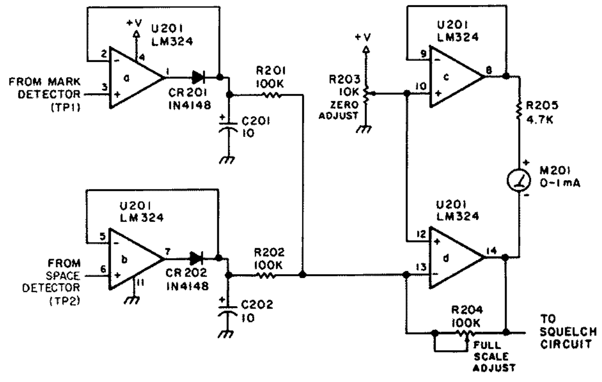


Fig. 3. Tuning indicator (optional).

tor levels on C7 and C8 are the same when no signal is present.

For CW operation, the transceiver can be tuned so that the CW tone is at 2125 Hz using the RIT control with S4 placed in the single-tone position. A signal that is high on key-down will then be sent to the computer. For sending, the interface circuit will depend on your transceiver. Fig. 4(a) shows a circuit which will key most solid-state rigs, 4(b) is a circuit for grid-block-keyed tube transmitters, and 4(c) shows a universal relay keying circuit for any type of rig.

Optional Extras

Like the economy car, this simple interface has some extra-cost options available. For instance, Fig. 3 shows a tuning-meter circuit using an LM324 quad op amp and a 0-1-mA meter which is very useful in making the fine-tuning adjustments required for accurate copy. It is very easy to use—just tune for maximum meter deflection and you are exactly on frequency. If you build the meter circuit, then adding a squelch to prevent on-screen "babbling" when tuning between signals is simple. The final section of the LM339 (U2d, Fig. 1) and a few extra components are all that is needed.

If your transceiver is not equipped for FSK operation, then it will be necessary to add an AFSK circuit such as the one in Fig. 5. This circuit uses an XR-2206 function generator to convert a TTL signal from the computer to an audio signal for the rig. It will be necessary to operate in the LSB mode (regardless of which band you are on) to obtain the correct mark and space tones.

Freq	R104	R105	R108	R109	R101	R107
2125	68k	10k	68k	10k	160k	220k
2210	68k	10k	68k	10k	51k	68k
2295	62k	10k	62k	10k	160k	220k
2550	56k	10k	56k	10k	160k	220k
2975	47k	10k	47k	10k	160k	220k
800	160k	100k	160k	100k	160k	220k

Table 1. Component values for active bandpass filters.

Another option for CW enthusiasts is to provide filters in the 800-Hz range for the input and mark BPFs and suitable switching to select CW or RTTY. This is not included on the schematics because I felt it was not sufficiently important to warrant the increased complexity. Those who operate computer CW a lot may wish to do this, however. Table 1 lists component values for a tuning range of 650–950 Hz.

Construction

Before beginning construction, you will have to investigate the manuals for your computer, the software you will be using with it, and your transceiver. If the computer has TTL-level I/O and the transceiver has a TTL-compatible FSK input (Commodore computers and ICOM transceivers, for instance), you should be able to build the interface exactly as shown. Just follow the instructions with your software to make the right connections to the computer. If some pieces of the puzzle don't fit exactly, then you will need to make the appropriate modifications. For instance, some computers have RS-232 I/O which will require level conversion to TTL. There seems to be some standardization among RTTY software programs as to polarities of input and output signals; however, this may not be true in all cases. Polarity conventions assumed here are: mark, high; space, low; key-down, high; PTT, low to transmit. As soon as you sort out all your polarities and levels, you are ready to start building.

Each block labeled BPF in Fig. 1 represents the active bandpass-filter circuit of Fig. 2. Each filter circuit is the same except for some resistor values which are listed in Table 1. R101 and R107 determine the Q of the filter and are reduced only in the case of the 2210-Hz input filter since it must pass a relatively wide band of frequencies. The mark and space filters are designed with the highest practical Q in order to provide maximum rejection of the opposite tone. Each BPF uses a single TL-084 bi-FET quad op amp. Do not substitute a conventional op amp since the performance of these filters depends partially on the characteristics of this IC. Use the best quality capacitors available for C103 and C104 to ensure good temperature stability.

A perforated prototyping board with holes on .1-inch centers makes for a neat layout and fast construction. The Radio Shack Dual Grid Board #276-161 is just the right size for this simple interface. Construction is not critical because operation is at audio frequencies. The TL-084s have a very high input impedance, so be careful to prevent stray coupling which could cause oscillation and ringing or reduce the effectiveness of the filter circuits. Use ferrite beads on all input and output leads and house the unit in a tight metal box to prevent rf from getting into the circuit. Shielded cables on all input and output lines including the cable to the computer are good practice, as well.

Alignment

When construction is completed you will need to

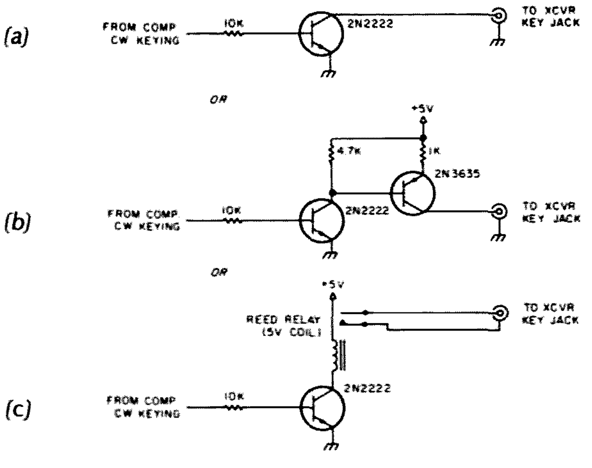


Fig. 4. CW keying circuits.

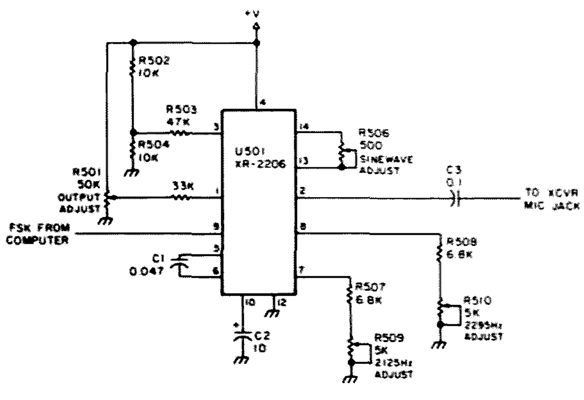


Fig. 5. AFSK circuit.

adjust all the pots for proper operation. How the unit performs will depend on how well the initial adjustments are made. To align the active filter circuits, you will need an audio signal generator or function generator and a frequency counter or an oscilloscope with very accurately calibrated horizontal sweep.

To align each filter, apply a signal of the correct frequency to the input and, observing the output with a scope, adjust R105 and R109 carefully for maximum output. If the frequency-determining capacitors, C103 and C104, are not close to their nominal values, you may find that the maximum output occurs at one extreme or the other of the pot's adjustment range. If this happens, it will be necessary to change the value of the resistor in series with the pot to the next higher or lower value. When you have peaked the filter to its center frequency, adjust the frequency control of the signal generator and observe that the output falls off rapidly and equally in both directions. You can now be assured that the filter is working correctly and will provide good performance.

Next, apply a sine wave of about 2 kHz to the audio input. With S1 in the OUT position and S2 in FM, increase the level until the output at pin 6 of U1 just becomes a square wave. Adjust R2 for the most symmetrical square wave possible. Change S2 to AM and observe that the output of U1 is now a sine wave.

If you are using the tuning meter of Fig. 3, adjust R203 to zero the meter with no audio applied and set R204 at mid-range. When adjusting R203, begin at the ground end and turn it only until the meter first reads zero.

You are now ready to put the interface on the air since the remainder of the adjustments are made with actual RTTY signals. Begin by connecting only the receiver audio and the computer. Load and run your software. Set S1 to IN, S2 to FM, S3 to 170 Hz, S4 to double-tone, S5 to normal, and S6 to OUT. Set R9 and R18 to mid-range. Tune in a strong clear signal until both mark and space LEDs are flashing. Tune the receiver carefully (preferably using a 10-Hz tuning rate) until the tuning meter reaches maximum deflection. Increase receiver volume until there is no further increase in meter indication and adjust R204 so that the meter reads about 80% of full scale. Print should be appearing on your screen. Adjust R18 in each direction until print begins to become garbled, then set it midway between these points. Switch to single-tone and adjust R9 so that copy is as good or nearly as good as it was. The adjustment of R18 is not critical on a good signal but becomes increasingly more so as signal quality worsens, so experiment a little with this control on poor signals before putting the lid on the box.

Now switch in the squelch and adjust R20 so that the squelch circuit does not interfere with normal copy but prevents any garbage from appearing on the screen when tuning between stations. Note that the squelch drops out quickly but takes a few seconds to pick up. It is normal for a few extraneous characters to be printed during the squelch tail.

If you are using the AFSK circuit of Fig. 5, connect a frequency counter and/or oscilloscope to the output and set all pots to mid-range. Ground pin 9 and adjust R510 for 2295 Hz; adjust R509 for 2125 Hz with pin 9 open. Adjust R506 for the best sine wave at the output. Set R501 to minimum and connect the AFSK signal to the mike jack of your rig; switch the rig to transmit in the LSB mode and leave the mike gain control in the usual position for phone operation. Increase R501 until you reach the output power you intend to use for RTTY operation.

Operation

Now that the alignment is completed, all that remains is to make the final connections to your transceiver and put your computer on the air. Most of the operating instructions depend on the software that you are using. You will find that usually it won't be necessary to touch the interface—all control will be from the computer keyboard and the transceiver tuning dial. For ham RTTY and ASCII operation, set the interface controls as follows: FM, 170-Hz shift, double-tone, normal polarity, squelch in. These settings should work for 99% of all ham communications. Now and then you might find that someone is using reverse polarity. To copy a nonstandard shift or CW, switch to single-tone detection. The squelch must be switched out in this mode since it will never drop out on a single tone. The majority of commercial communications use 425-Hz shift and reverse polarity.

Now you can begin to enjoy keyboard operation. Whether you are a newcomer to this mode of operation or a RTTY old-timer, you will no doubt find exploring the world of computerized communication very interesting. This simple interface will provide good performance on RTTY, CW, and ASCII up to 110 baud. You will be able to chat with other hams, check into special-interest nets, leave messages for friends on radio bulletin boards, and if you have general-coverage receive, check out the press services, ship-to-shore communication, etc., outside the ham bands. Hope to see you soon on RTTY.■

✓ See List of Advertisers on page 80

Robin Rumbolt WA4TEM
1134 Glade Hill Drive
Knoxville TN 37919

Is Your Repeater Dying?

With this 16-channel telemetry encoder, you have a remote chance of finding out.

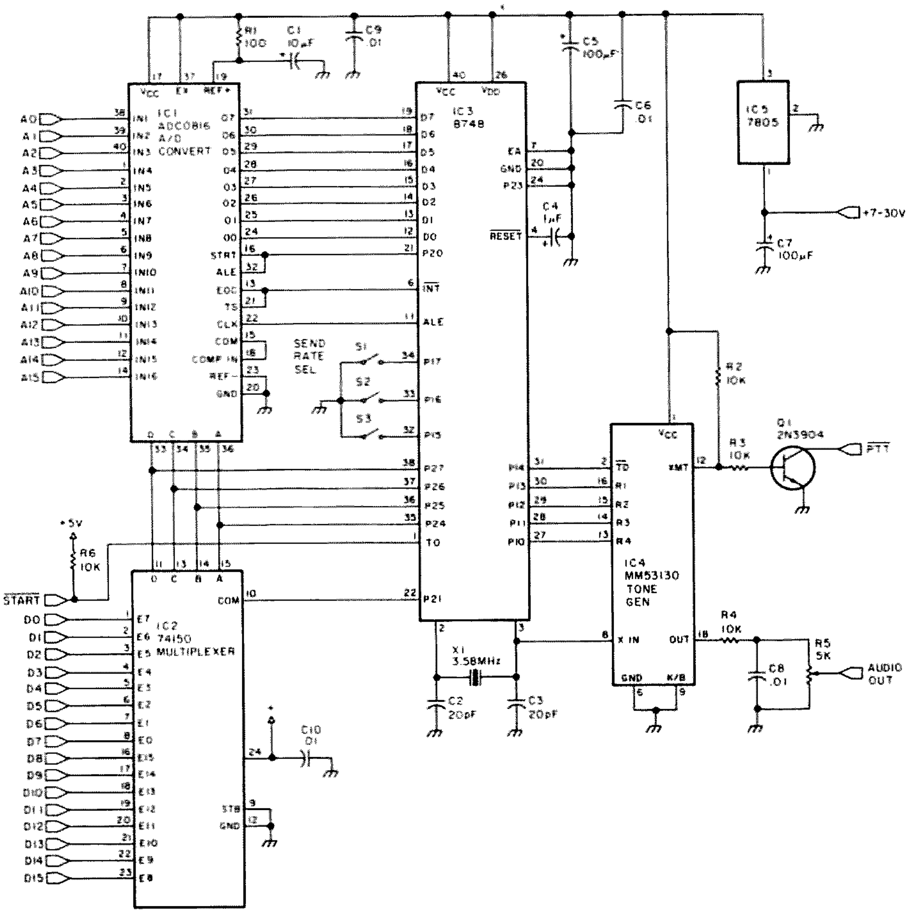


Fig. 1. Schematic.

Why go to all the trouble to downlink your repeater's telemetry at a speed and format that only a computer can handle? After all, most computers are not very portable. Modems and FSK generators can be expensive. Voice synthesizers tell your data to the world. Reading repeater parameters while mobile or portable can be exceedingly difficult.

This simple telemetry encoder will take a 6-millisecond "snapshot" of 16 analog and 16 digital channels and then downlink them as a series of high-speed touchtones™. When used with the touchtone data display that I described in the December, 1984, issue of *73* and a handie-talkie, you can have an inexpensive, secure system for readout of repeater parameters wherever you are.

Circuit Description

I like to keep circuits as simple as I can to minimize construction time. Therefore, I used an Intel 8748 mi-

```
0000                *****  TOUCHTONE TELEMETRY ENCODER ROUTINE *****
0000                ****  BY ROBIN RUMBOLT  WA4TEM 3/28/83 ****
0000                       ORG   0
0000 15             START  DIS   I
0001 24 00          XMIT   JMP   0100H
0003                       ORG   100H
0100 35             XMT    DIS   TCNT        ; DISABLE TIMER INTERRUPT
0101 B8 20                 MOV   R0,020H
0103 A5                    CLR   F1          ; SET FIRST TIME THRU FLAG
0104 B5                    CPL   F1
0105 27                    CLR   A           ; INITIALIZE PORTS
0106 39                    OUTL  P1,A
0107 3A                    OUTL  P2,A
0108 AA                    MOV   R2,A
0109 36 00                 JT0   XMT         ; WAIT FOR START LINE TO GO LOW
010B FA             REDAN  MOV   A,R2        ; BEGIN READING ANALOG DATA
010C 47                    SWAP  A
010D 3A                    OUTL  P2,A        ; OUTPUT CHANNEL ADD TO A/D
010E 8A 01                 ORL   P2,01H      ; GENERATE START PULSE
0110 9A FE                 ANL   P2,00FEH
0112 BF 0F                 MOV   R7,00FH     ; SET CHANNEL COUNTER
0114 EF 14          HERE   DJNZ  R7,HERE     ; WAIT FOR A/D CONVERSION
0116 15             HERE2  DIS   I
0117 86 16                 JNI   HERE2       ; CHECK FOR END OF CONVERSION SIGNAL.
0119 08                    INS   A,BUS       ; READ IN DATA
011A A0                    MOV   @R0,A       ; STORE IT
011B 18                    INC   R0
011C 1A                    INC   R2
011D FA                    MOV   A,R2
011E 03 F0                 ADD   A,00F0H
0120 C6 24                 JZ    DIG         ; CHECK FOR ALL ANALOG CHANNELS READ
0122 24 0B                 JMP   REDAN       ; IF NOT, GET NEXT CHANNEL
0124 27             DIG    CLR   A           ; GET READY TO READ DIGITAL CHANNELS
0125 AA                    MOV   R2,A
0126 FA             REDIG  MOV   A,R2
0127 47                    SWAP  A
0128 43 02                 ORL   A,002H
012A 3A                    OUTL  P2,A        ; OUTPUT DIGITAL CHANNEL ADR
012B F0                    MOV   A,@R0
012C 97                    CLR   C
012D F7                    RLC   A
012E A0                    MOV   @R0,A
012F 0A                    IN    A,P2        ; INPUT CHANNEL DATA
0130 37                    CPL   A           ; INVERT THE BIT
0131 53 02                 ANL   A,002H
0133 97                    CLR   C
0134 67                    RRC   A           ; SHIFT IT IN TO DATA WORD
0135 40                    ORL   A,@R0
0136 A0                    MOV   @R0,A
0137 1A                    INC   R2
0138 FA                    MOV   A,R2
0139 03 F8                 ADD   A,00F8H
013B C6 44                 JZ    NDIG        ;CHECK TO SEE IF BIT BELONGS IN SECOND DATA WORD
013D FA                    MOV   A,R2
013E 03 F0                 ADD   A,00F0H
0140 C6 47                 JZ    BGN         ; CHECK FOR ALL CHANNELS READ
0142 24 26                 JMP   REDIG       ;IF NOT, GET NEXT CHANNEL
0144 18             NDIG   INC   R0
0145 24 26                 JMP   REDIG
0147 B8 20          BGN    MOV   R0,020H
0149 BA 00                 MOV   R2,00H      ;INITIALIZE REGISTERS
014B BF 12                 MOV   R7,012H
014D FA             NV     MOV   A,R2        ;GET CHANNEL NUMBER
014E AB                    MOV   R3,A
014F 34 B0                 CALL  CONV        ;CONVERT TO BCD
0151 FD                    MOV   A,R5
0152 53 F0                 ANL   A,00F0H     ;PICK OUT FIRST DIGIT
0154 47                    SWAP  A
0155 C6 59                 JZ    A1          ;IF IT IS ZERO DO NOT SEND IT
0157 34 88                 CALL  OUTA        ;ELSE SEND IT
0159 FD             A1     MOV   A,R5
015A 53 0F                 ANL   A,00FH      ;PICK OUT SECOND DIGIT
015C 34 84                 CALL  OUT         ;SEND IT
015E 23 0C                 MOV   A,00CH      ;SEND HYPHEN
0160 34 84                 CALL  OUT
0162 F0                    MOV   A,@R0       ; GET CHANNEL DATA
0163 18                    INC   R0
0164 AB                    MOV   R3,A
0165 34 B0                 CALL  CONV        ;CONVERT TO BCD
0167 FC                    MOV   A,R4
0168 C6 6C                 JZ    E1          ; IGNORE LEADING ZERO
016A 34 88                 CALL  OUTA
016C FD             E1     MOV   A,R5
016D 53 F0                 ANL   A,$0F0H
016F 47                    SWAP  A
0170 34 84                 CALL  OUT         ;SEND DIGIT
0172 FD                    MOV   A,R5
0173 53 0F                 ANL   A,00FH
0175 34 84                 CALL  OUT         ;SEND NEXT DIGIT
0177 27                    CLR   A
0178 34 88                 CALL  OUTA        ;SEND A BLANK
017A 1A                    INC   R2
017B EF 4D                 DJNZ  R7,NV
017D 24 00                 JMP   XMT         ; CHECK FOR ALL DATA SENT
017F 03 04          ADT    ADD   A,04H       ;ADD EXTRA TIME TO 1ST DIGIT SENT
0181 A5                    CLR   F1
0182 24 96                 JMP   CON
0184 96 88          OUT    JNZ   OUTA        ;TOUCHTONE OUTPUT ROUTINE
0186 23 0A                 MOV   A,00AH
0188 43 10          OUTA   ORL   A,010H
018A 39                    OUTL  P1,A
018B 89 E0          DELAY  ORL   P1,00E0H
018D 09                    IN    A,P1        ;READ IN RATE SELECT SWITCH VALUE
018E 53 E0                 ANL   A,00E0H
0190 47                    SWAP  A
0191 77                    RR    A
0192 03 02                 ADD   A,02H
0194 76 7F                 JF1   ADT         ;CHECK FOR FIRST DIGIT DELAY
0196 AE             CON    MOV   R6,A
0197 23 3A          GO     MOV   A,03AH      ;SET ONBOARD TIMER FOR DELAY
0199 62                    MOV   T,A
019A 55                    STRT  T
019B 16 9F          WAIT   JTF   NEXT        ; WAIT FOR TIMER OVERFLOW
019D 24 9B                 JMP   WAIT
019F EE 97          NEXT   DJNZ  R6,GO
01A1 99 E0                 ANL   P1,00E0H    ;KILL TONE OUTPUT
01A3 BE 02                 MOV   R6,02H
01A5 23 3A          GO2    MOV   A,03AH      ; SET TIMER FOR OFF DELAY
01A7 62                    MOV   T,A
01A8 55                    STRT  T
01A9 16 AD          WAIT2  JTF   NEXT2
01AB 24 A9                 JMP   WAIT2
01AD EE A5          NEXT2  DJNZ  R6,GO2
01AF 93                    RETR
01B0 27             CONV   CLR   A           ; BINARY TO BCD CONVERSION ROUTINE
01B1 AC                    MOV   R4,A        ;TAKES BINARY VALUE FROM R3 AND PUTS
01B2 AD                    MOV   R5,A        ;RESULTS IN R4 & R5
01B3 FB             S100   MOV   A,R3
01B4 03 9B                 ADD   A,09BH
01B6 AB                    MOV   R3,A
01B7 E6 BE                 JNC   A100
01B9 1C                    INC   R4
01BA 17                    INC   A
01BB AB                    MOV   R3,A
01BC 24 B3                 JMP   S100
01BE FB             A100   MOV   A,R3
01BF 03 65                 ADD   A,065H
01C1 AB                    MOV   R3,A
01C2 FB             S10    MOV   A,R3
01C3 03 F6                 ADD   A,00F6H
01C5 AB                    MOV   R3,A
01C6 F2 CB                 JB    7,AD10
01C8 1D                    INC   R5
01C9 24 C2                 JMP   S10
01CB FB             AD10   MOV   A,R3
01CC 03 0A                 ADD   A,00AH
01CE AB                    MOV   R3,A
01CF FD                    MOV   A,R5
01D0 47                    SWAP  A
01D1 6B                    ADD   A,R3
01D2 AD                    MOV   R5,A
01D3 93                    RETR
SYMBOL TABLE
A1     0159   A100   01BE   AD10   01CB   ADT    017F   E1     016C
BGN    0147   CON    0196   CONV   01B0   DELAY  018B   DIG    0124
GO     0197   GO2    01A5   HERE   0114   HERE2  0116   NDIG   0144
NEXT   019F   NEXT2  01AD   NV     014D   OUT    0184   OUTA   0188
REDAN  010B   REDIG  0126   S10    01C2   S100   01B3   START  0000
WAIT   019B   WAIT2  01A9   XMIT   0001   XMT    0100
```

Fig. 2. Program listing.

croprocessor to simplify the circuitry. The circuit shown in Fig. 1 uses only 5 ICs, if you count the voltage regulator.

IC1, a National ADC0816, is an 8-bit A/D converter combined with a 16-channel multiplexer. Given a channel address, a start pulse, and some clock pulses, this converter can do a complete conversion in just a few microseconds. The ADC0816 has an on-board analog multiplexer which eliminates the need for an external multiplexer. This multiplexer connects one of its 16 input lines to the input of the A/D converter, depending on which input is addressed by the microprocessor.

IC2, a 74150 16-bit multiplexer, does the same job as IC1, except that it does it for digital signals. A 74C150 would be a better choice for this spot (since it is CMOS and therefore has a much lower current drain), but I didn't have one, so I just plugged in the regular TTL version instead. If you have a 74C150, you can just substitute it since the two ICs are pin compatible.

The 8748 microprocessor, IC3, controls the whole show. It addresses and operates the A/D converter, the digital multiplexer, and the touchtone generator. It receives data, converts it to the proper format, and then outputs it at the switch-selected rate.

The National MM53130 touchtone generator, IC4, not only generates the standard 16-digit tone pairs, but it also outputs a push-to-talk signal for keying the downlink transmitter. This PTT signal is only present while the tone is on, however. So, if you do not want your transmitter to drop out between tones, you might

		Parts List	
1	R1	Resistor, 100 Ohms, ¼ W, 20%	$ .06
4	R2–R4, R6	Resistor, 10k Ohms, ¼ W, 20%	.24
1	R5	Trimpot, 5k Ohms, ¼ W, 20%	.59
1	C1	Capacitor, 10 µF, 16 V, electrolytic	.49
2	C2–C3	Capacitor, 20 pF, 50 V, disc ceramic	.39
1	C4	Capacitor, 1 µF, 16 V, electrolytic	.49
2	C5, C7	Capacitor, 100 µF, 35 V, electrolytic	1.58
4	C6, C8–C10	Capacitor, .01 µF, 50 V, disc ceramic	.32
1	Q1	Transistor, 2N3904 NPN or equivalent	.30
1	IC1	IC, ADC0816 A/D converter	9.95
1	IC2	IC, 74150 16-line multiplexer	1.35
1	IC3	8748 microprocessor (see text)	50.00
1	IC4	IC, MM53130 DTMF encoder	5.95
1	IC5	IC, LM7805 5-V regulator	1.59
1	X1	Crystal, 3.579 MHz, TV burst	1.99
2	———	40-pin IC socket	.98
1	———	24-pin IC socket	.33
1	———	18-pin IC socket	.24
1	S1–S3	3- or 4-position DIP switch	1.19
1	———	PC board (see text)	10.00

want to add a small delay circuit. The one advantage that the MM53130 has over other touchtone generator chips is that it will accept either 2-of-8-type inputs *or* standard 4-line binary inputs. Other generator ICs accept only the 2-of-8-style inputs.

Lastly, a 7805 three-terminal, 5-volt regulator is used to supply a constant voltage for the entire circuit.

Software

The microprocessor program that runs the telemetry encoder is shown in Fig. 2. Since it is commented fairly well, I'll just briefly outline it here:

Lines 40–60 direct the microprocessor to the transmit program located at address 100 hex. I put the transmit-routine start point at that location in order to make room for the data-display routine that was described in the previous article. Neither program is very long, so I put them both in memory simultaneously. That way I could easily swap the processor from one circuit to another. When the microprocessor first wakes up or is reset, it immediately goes to location 0 for its first instruction. That is why I put the vector there.

Lines 70–150 form the instruction loop that the processor stays in until the start line is grounded. When that happens, the processor begins executing lines 160–590, which comprise the part of the program that reads all the analog and digital channel values and stores them in memory.

Once the data is all gathered, it must be formatted and sent out to the touchtone generator. Lines 600–940 take care of these chores.

Program instructions at lines 950–1240 form the OUTput subroutine which routes the data to the touchtone generator and ensures proper pulse durations.

The CONVert subroutine, lines 1250–1520, performs a binary-to-BCD conversion on all channel numbers and

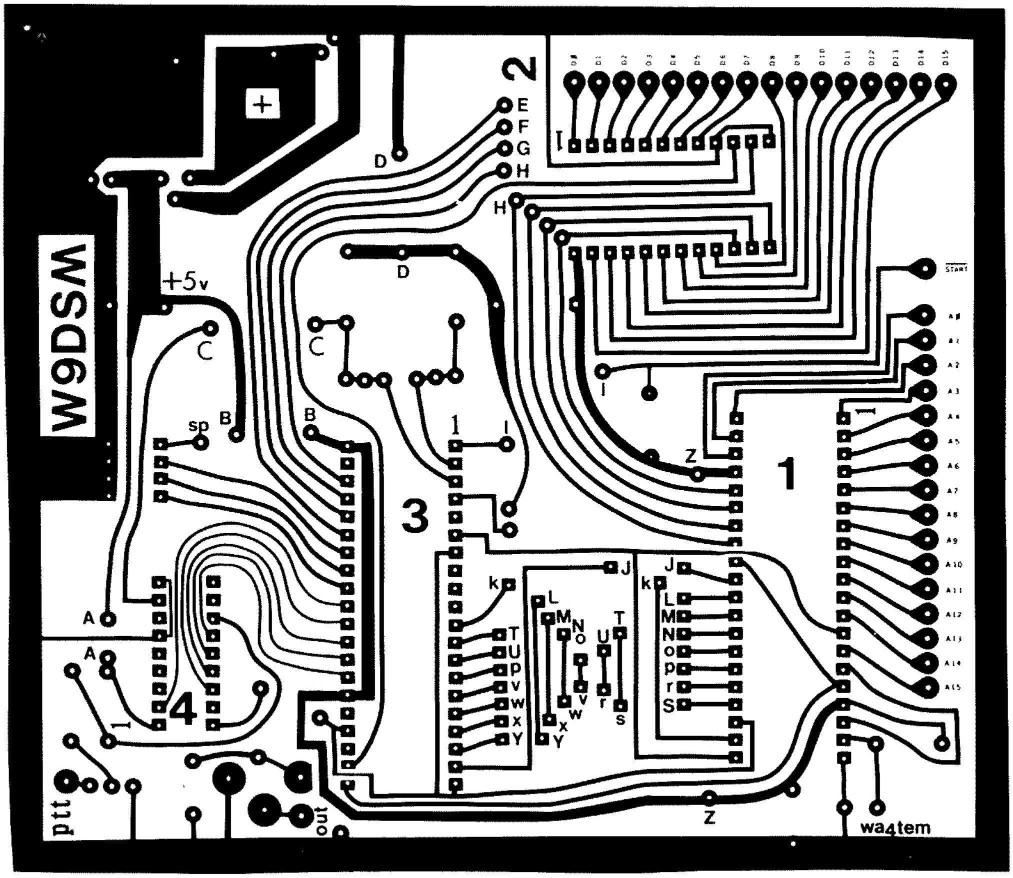
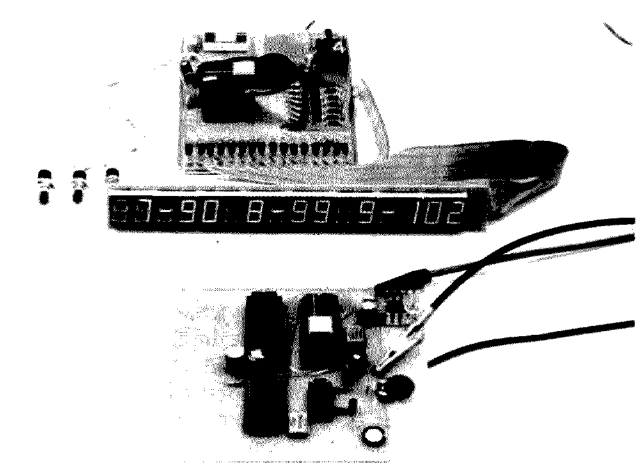


Fig. 3. PC board, foil side.

data. I convert all numbers to BCD instead of sending them out in hex format because the touchtone generator can only generate 16 tone pairs and the display unit uses three of those for special symbols. That doesn't leave enough characters to represent the hex characters 0-9 and A-F. So I had to send everything in BCD.

Construction

A printed circuit board was developed for this circuit and is shown in Fig. 3. The parts-placement diagram is shown in Fig. 4. Due to the relatively large number of lines needed to interconnect the ICs, about 25 jumpers were needed on the board. These could have been eliminated by using a double-sided PC board, but that would have made the board much harder to duplicate. The jumpers are all designated by single letters A-Z. Simply connect points labeled with the same letter: A to A, B to B, C to C, etc. I recommend that all parts be installed on the board before wiring the jumpers, except for jumpers E through H. These jumpers are very close to the end of IC2 and might be more easily installed before the IC socket is soldered on. Note that in this group only jumper H is labeled on both ends. This is due to the fact that there just wasn't room to put labels on the board. These few jumpers are short and are shown on the parts-placement diagram. Also note that jumper Q is not labeled on the board, but it is shown on the parts-placement drawing (near pin 25 of IC3).



Touchtone telemetry encoder prototype shown with data display unit.

Two sets of holes have been provided for crystal X1, a TV color-burst crystal. This is to allow easy use of either the large or small style of burst crystal.

The regulator, IC5, should

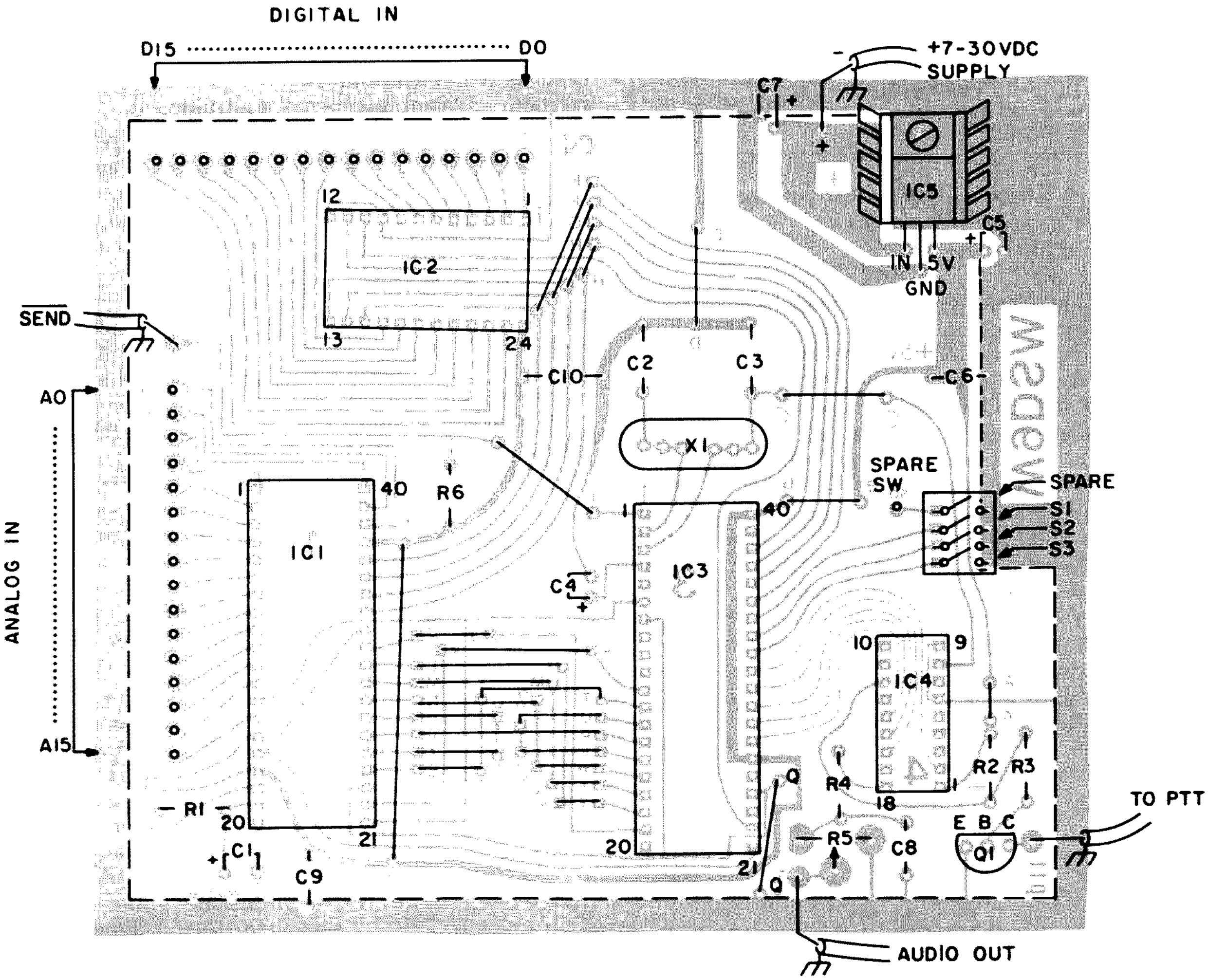


Fig. 4. Parts placement.

be provided with a heat sink since it can get quite warm. Space is provided for a TO-220-style heat sink.

Power-up should be preceded by a voltage check with IC5 in place and all other ICs removed. Check the power pins of all ICs for +5 volts. If they all check out, disconnect power and install the remaining ICs. Observe that IC4 is installed with its pin 1 pointing in the opposite direction from IC3.

Although this circuit can be powered by any voltage from about 6 to 30 volts, the analog and digital inputs must be limited to a maximum of 5 volts (or IC damage can occur). So be careful what you connect to the inputs.

Operation

The circuit begins operating when the START line is pulsed low. First, all sixteen analog channels are sampled. The ADC0816 A/D converter generates an 8-bit digital representation of a 0-to-5-volt analog input. Each of the 16 analog inputs is sampled one at a time with the results stored in microprocessor memory. Then the digital inputs are sampled. Each digital bit is shifted into a memory location shift-register style. When all sixteen digital bits are sampled, they are stored in memory as two eight-bit words. The entire sampling and conversion process takes only about 6 milliseconds.

The microprocessor then begins the data formatting and outputting process. First, a channel number is output to the touchtone generator. Channel numbers range from 0 to 17. That includes channels 0 through 15 for the 16 analog channels, and channels 16 and 17, which are the two eight-bit words containing the 16 digital channel bits. A "−" is then sent (# on a touchtone pad) to serve as a separator between channel number and data. Next, the channel's data is retrieved from memory and converted to a three-digit BCD number ranging from 0 to 255. Then these three digits are sent. Lastly, a space (D on most 16-digit touchtone pads) is sent to separate channels on the display. Leading zeroes are omitted on both channel numbers and data to minimize the sending time. The sending rate of 12 to 25 seconds per complete cycle can be varied in eight steps by setting the Sending Rate Selector switches, S1-S3. The fastest rate is selected when all switches are closed. At the fastest rate, each touchtone is on for approximately 35 milliseconds, followed by a silence period of equal duration. The very first touchtone sent in a cycle (channel 0) is held on slightly longer to allow transmitters and receivers in the downlink system to come alive. The resulting format and timing of all this outputting is shown in Fig. 5.

To easily interpret the displayed analog data received on the downlink, I made use of a simple nomograph shown in Fig. 6. Numbers from 0 to 255 are scaled along one side of the vertical line. Numbers representing whatever data is to be measured can be put on the left side of the line. For example, if you are measuring temperature, a scale from −40 to +150 degrees may be drawn on the left of the line. Then if the downlinked data reads 182, you can simply find 182 on the right side of the line and read the correct temperature corresponding to that value on the left side.

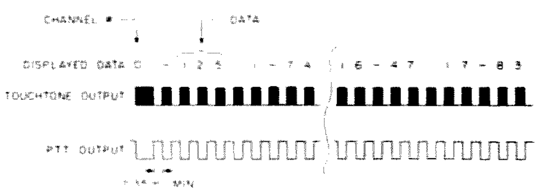


Fig. 5. Timing diagram.

Fig. 6. Nomograph.

Conclusion

One change that you might wish to incorporate in this circuit is to change the crystal frequency in order to move the generated tones off the standard touchtone frequencies. This would not only ensure link security, but it would also prevent some idiot with a tape recorder from wreaking havoc by recording the telemetry stream and playing it back on your repeater or control-link input frequency. Any crystal frequency from 1 to 4 MHz ought to work just fine.

Be sure to change the crystal in your data-display circuit as well so that it will decode properly.

I want to thank Bill Kaylor W9DSM for developing the printed circuit board for this project. Thanks also to Paul Hamilton for his photographic assistance.

Printed circuit boards are available from the author for $10.00. Preprogrammed and tested 8748 microprocessors are available for $50.00. ■

BARTER 'N' BUY

Individual (noncommercial) ....25¢ per word
Commercial ....60¢ per word

Prepayment by check or money order is required with your ad. No discounts or commissions are available. Please make your payment to *73*. Rates for multiple insertions are available on request.

Advertising must pertain to amateur radio products or services. No special layouts or positions are possible. All advertising copy must be submitted typewritten (double-spaced) and must include full name and address. Copy limited to 100 words, maximum. Count only words in text. Address, free.

73 cannot verify advertising claims and cannot be held responsible for claims made by the advertiser. Liability will be limited to making any necessary corrections in the next available issue.

Copy must be received in Peterborough by the 5th of the second month preceding the cover date.

Send to Barter 'N' Buy, c/o Nancy Ciampa, Advertising Department, *73*, Elm Street, Peterborough NH 03458.

WANTED: Cash paid for used speed radar equipment. Write or call: Brian R. Esterman, PO Box 8141, Northfield IL 60093; (312)-251-8901. BNB030

MILITARY TECHNICAL MANUALS for old and obsolete equipment. 60-page catalog, $3.00. Military Technical Manual Service, 2266 Senasac Ave., Long Beach CA 90815. BNB045

MAGICOM RF SPEECH PROCESSORS—Add 6 dB of average output with genuine rf clipping in your transmitter's i-f stage. Custom engineered for Kenwood TS-120, TS-130, TS-430, TS-520, TS-530, TS-820; Drake T-4X, TR-7; Yaesu FT-102. Excellent speech quality, simple installation, affordable prices! SASE for data and cost. Magicom, PO Box 6552A, Bellevue WA 98007. BNB101

REPAIR, alignment, calibration. Collins written estimates, $25; non-Collins, $50. K1MAN, (207)-495-2215. BNB117

IMRA—International Mission Radio Association helps missionaries by supplying equipment and running a net for them daily except Sunday, 14.280 MHz, 1900-2000 GMT. Br. Bernard Frey, 1 Pryer Manor Rd., Larchmont NY 10538. BNB123

NEW HAM-SWL SOCIETY for unity of thought & learning. Open to all. Many topics, awards, free ad space in periodical, society net, museum participation. Shack pics & QSLs welcome. Writers needed. SASE for info to RCSW, 32 Applegate, Bennington VT 05201. BNB197

CHESS PLAYERS—Radio-chess schedules, matches, tournaments. Details. K2VJ, Box 682, Cologne NJ 08213. BNB207

CX7 REPAIRS. Mark Mandelkern, 2315 Derby St., Berkeley CA 94705; (415)-549-9210. BNB213

SCHEMATICS: Radio receivers 1920s/60s. Send name, brand, model no., SASE. Scaramella, PO Box 1, Woonsocket RI 02895-0001. BNB214

HAM RADIO REPAIR, tube through solid state. Robert Hall Electronics, PO Box 8363, San Francisco CA 94128; (408)-729-8200. BNB219

HAM TRADER YELLOW SHEETS, in our 23rd year. Buy, swap, sell ham-radio gear. Published twice a month. Ads quickly circulate—no long wait for results. SASE for sample copy. $9 for one year (24 issues). POB 356, Wheaton IL 60189. BNB220

DX HEADING MAPS for Boston, NYC, Phila., Baltimore, Detroit, Atlanta, Chicago, New Orleans, Saint Louis, Dallas, LA. 11 × 17 $1.75 pp. 22 × 34 $5.95 pp. Specify city. Bill Massey W2HOJ, PO Box 397, Hainesport NJ 08036. BNB221

YOUR IC-720 can become a sophisticated computer-controlled scanner. Keyboard frequency entry, 64 memories, memory scan, mode scan, station lists, more. No interface required, just a cable—directions included. Software cassette for Commodore 64, $14.75 pp. David Oliver W9ODK, RR 2 Box 75A, Shevlin MN 56676. BNB228

HIGH-QUALITY, LOW-COST courtesy beepers for your transmitter or repeater. Kit $14, assembled $18. YBM Enterprises, 8502 N. Oketo Ave., Niles IL 60648. BNB231

GREAT CIRCLE BEARINGS—stop guessing. Send us your QTH or your latitude and longitude and get a personal accurate computer printout of headings and mileage from your own QTH to over 500 cities and countries throughout the US and the world, $3.95. APCA Systems, PO Box 978, Arbuckle CA 95912. BNB233

C-64 AND VIC-20 ham software: Over a dozen programs for each computer. LSASE for catalog. Specify computer. Walt KA9GLB, 4880 N. 49th St. Dept 7, Milwaukee WI 53218. BNB248

COMMODORE 64 CW INSTRUCTOR PROGRAM. Generates CW on TV speaker. Random code, keyboard input, or prerecorded "CW Tests." Character speed and spacing set independently. Designed for classes and increasing code speed. $15.00—diskette or cassette (specify). N7BCU, Dennis Olver, 22000 S. Tonya Ct., Beavercreek OR 97004. BNB249

QSLS on wood grain, glossy, and brightly-colored card stocks. Samples 40¢. QOF Press, Dept. 2, 505 S. Barstow #212, Eau Claire WI 54701. BNB250

DIGITAL AUTOMATIC DISPLAYS for FT-101s, TS-520s, Collins, Drake, Heath, Swan, and others. Six 1/2" red LED digits in a 5"-wide by 1-1/2"-high by 9"-deep metal cabinet. See last month's ad. Write for prices and information. GRAND SYSTEMS Dept. A, PO Box 3377, Blaine WA 98230; (604)-530-4551. BNB251

TS-1000, TS-2068, TI 99/4A, VIC-20 SOFTWARE: Free catalog. Turn your programs and projects into profits. Antenna design, circuit design, code practice. Midwest Software Co., 9922 Harwich Dr., Crestwood MO 63126-2318. BNB252

KENWOOD TS-430S OWNERS ONLY! Jabco's Stop Scan! All-mode, squelch-operated (when the squelch breaks the scan stops!), adjustable resume scan delay. Automatic operation ("HOLD" overrides Stop Scan). 6-wire connection (4 plug into existing sockets, 2 solder). No mods! No cut traces! Small 1-3/4" PC board. Easy kit with instruction manual—$18.95. Assembled (100% checked and guaranteed) with manual—$28.95 (Indiana residents include 5% sales tax). Jabco, R1 Box 386, Alexandria IN 46001. BNB253

BUILD ONE-TRANSISTOR HAM RECEIVER, or simple way to change radio to hearing aid, or no-chemical printed circuit boards. Process instructions, each $2.00. Kenneth Hand WB2EUF, PO Box 708, East Hampton NY 11937. BNB254

GET IN NOW...the demand for burglar alarms is everywhere. Learn this booming business. It's easy. We can help you. Starting information: $2.00. Dynamic Security Marketing, PO Box 1456-H, Grand Rapids MI 49501. BNB255

COMMODORE 64 5-BAND DXCC LOG includes custom beam headings, distances to DX, plus continent, country, zones QSOed/QSLed on any band, phone or CW, upon country name or callsign entry. Diskette and instructions $18.99, ppd. Sondor Software, PO Box 416, Sarnia, Ontario, Canada N7T 7J2. BNB256

1.2-GHZ EQUIPMENT WANTED: I would like to trade the following mint-condition equipment for the ICOM RP-1201 repeater and/or the IC-120 mobile transceiver. I have: Atlas 210-X with power supply in excellent condition, IC-4AT new, IC-2AT new, and Clegg FM-27 2-meter synthesized 25-Watt mobile, in fine shape. No modifications on any of this equipment. Blaine Hamrick WB5LSJ, PO Box 610173, DFW Airport TX 75261. BNB257

EXPIRED HAM LICENSE PLATES wanted for collection: Will pay reasonable price for plates in good shape, and of course will pay all postage. Blaine Hamrick WB5LSJ, PO Box 610173, DFW Airport TX 75261. BNB258

JENNINGS UCSL-1000 VACUUM VARIABLE CAPACITORS, 10 through 1000 pF at 5000 kV with gear drive train and mounting bracket. Ideal for that linear amplifier or tuner: $59.50. HP608C lab-quality signal generator, 10 MHz through 480 MHz, perfect for HF/VHF/UHF alignment: $345.00. HP614A signal generator, 900 MHz to 2100 MHz: $345.00. HP618B, 3.8 GHz through 7.6 GHz: $375.00. Jerrold 900C sweep generator, 500 kHz to 1200 MHz: $345.00. Antique National Radio NC-TV7M, table top, 7" TV in original grey HRO-style metal cabinet: $245.00. Collins new 637T-1 portable dipole, 3 MHz through 30 MHz dipole reel-type antenna: $245.00. All equipment lab checked. We accept M/C, Visa, or check. Phone Bill Slep, (704)-524-7519, Slep Electronics Company, Highway 441, Otto NC 28763. BNB259

QSLS to order. Variety of styles, colors, card stock. W4BPD QSLs, PO Drawer OX, Cordova SC 29039. BNB260

THE DX'ERS MAGAZINE. Up-to-date, informative, interesting. Compiled and edited by Gus Browning W4BPD, DXCC Honor Roll Certificate #4. Send for *free* sample and subscription information today. PO Drawer DX, Cordova SC 29039. BNB261

TUBES FOR SALE: ham, audio, communications, marine and aircraft. We match pairs for audio. Have CCTV cameras. *Free* antique tube with $100.00 order. Write ARS Electronics, 7110 DeCelis Place, Van Nuys CA 91406. Phone: (818)-997-6200. Telex (RCA): 215706ARSE. BNB262

COLOR COMPUTER CONTESTERS! Detect dupes. Log up to 2560 calls. K0TW Contest Program now available from K0TW (no middle man). Machine language, requires minimum 16K. $9.95 for tape version or $1 (refundable) for detailed description. Tom Workman K0TW, Rt. 9 Box 688, Tucson AZ 85743. BNB263

QSLS AND RUBBER STAMPS. Top quality. QSL samples and stamp information, 50¢. Ebbert Graphics D-7, Box 70, Westerville OH 43081. BNB264

COCO OWNERS—Free software and hardware brochure. CoCoNuts, POB 9886, San Jose CA 95157-0866. BNB265

ELECTRONICS TECHNOLOGY COURSE. 34-credit, excellent for FCC license prep., $50. Trade for 2m or 450 transceiver. K6KZT, 2255 Alexander, Los Osos CA 93402. BNB266

BEARING AND DISTANCE CHART. 23 pages of data lists. Antenna headings and distances to 600+ locations worldwide. Computer-generated chart is based on your QTH. User's guide included. Allows you to aim your dipole or beam toward areas you wish to work. Legible print, bond paper, vinyl cover, shipped flat. $10.00 complete (CA add 6½%). Dawn Mackey, Box 1157, Felton CA 95018 (XYL NW6U). QSL for info/sample. BNB267

How Good Is Six?

Try 50 MHz with a transceiver you've built from scratch. There's no greater pleasure than saying, "I did it myself!"

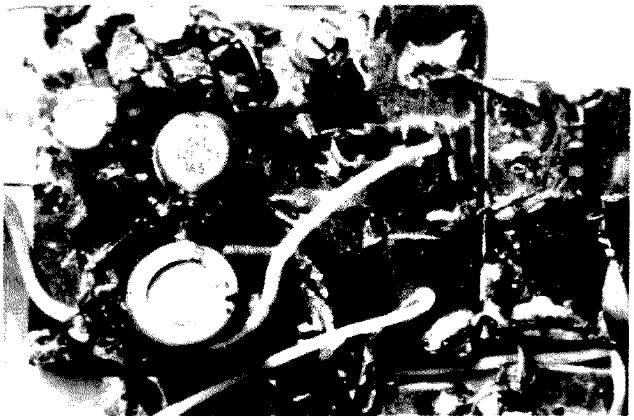


Photo A. Close-up of balanced modulator showing X-acto® - knife "cut and slash" construction technique.

Larry Jack KL7GLK
#1 East Lake Drive
Bay Ridge, Annapolis MD 21403

This would be a good evening for a test, I thought. Several conversations drifted through the speaker as I glided along the bottom of the six-meter phone band. There was a strong summer E opening to the south. "Well, here goes," I said, and I let out a CQ. I had just finished building the transceiver that afternoon and, although its transmitter is only half a Watt, by the end of the opening it had netted ten states and a Caribbean island. I had faith in my simplistic design, but this performance was even better than I had expected.

This is an article on how to construct a six-meter sideband transceiver. I originally planned to write it in a concise, technical manner, when a non-ham friend's observation made me re-

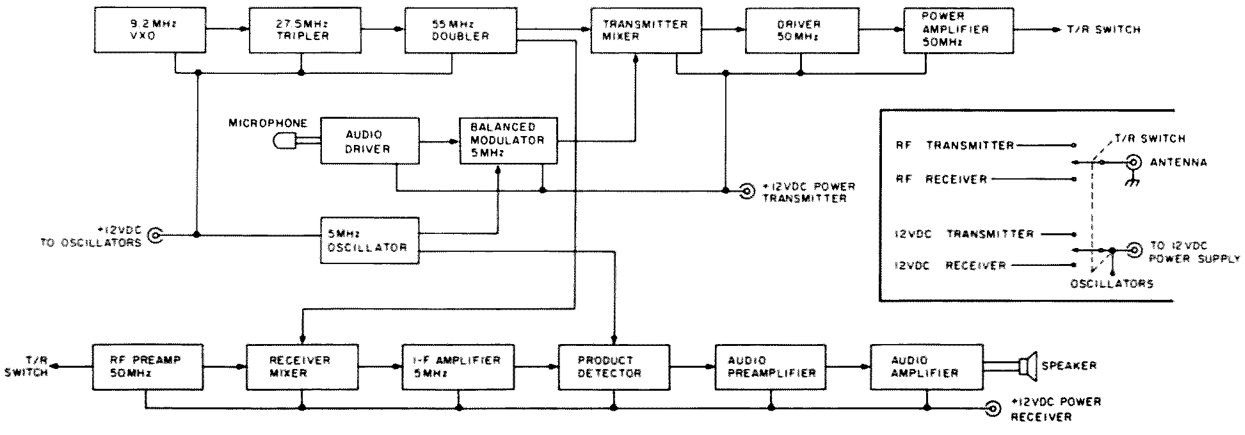


Fig. 1. Block diagram of a 50-MHz transceiver.

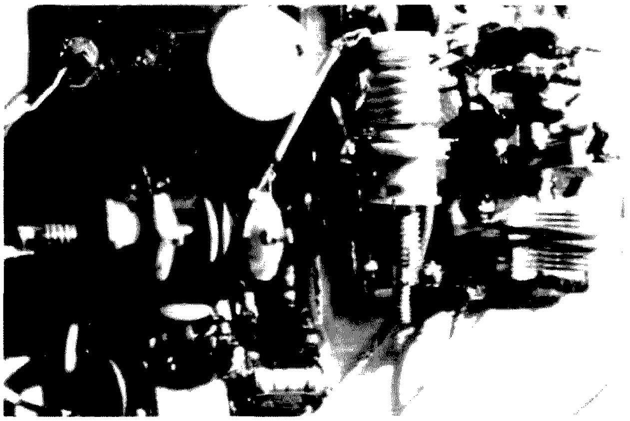


Photo B. Close-up of receiver mixer stage showing detail of coil windings found throughout the transceiver.

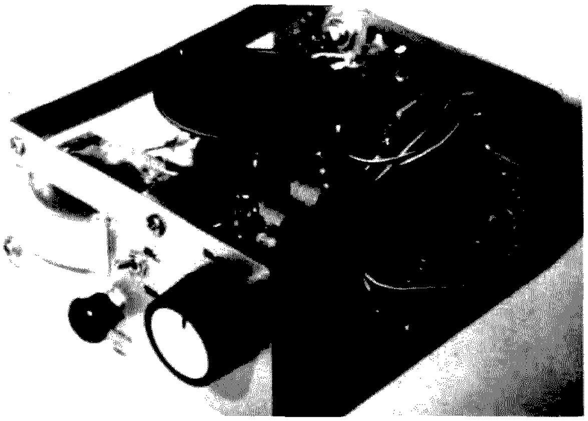


Photo C. Completed 6m DSB transceiver.

think my approach. After looking over the completed schematic, her comment was, "I wouldn't know where to begin building *that*!" I realized something forgotten years ago: It is awful to have the desire to build when you think you lack the technical skills.

Reassurance

The truth is that if you can get a one- or two-transistor project to work, then working with ten times that number of transistors really isn't any more difficult. It requires going step by step and making sure everything is correct before proceeding. In the end the pieces will all slide into place. It is this step-by-step approach I've taken with this transceiver. It is easy to become overwhelmed, so look only at each circuit stage. When it is all together, you appreciate the complexity. In the end you say, "I built that!"

Theory

The transceiver has a 5-MHz crystal oscillator that is used both for DSB generation in the transmitter and for bfo injection for the direct-conversion receiver. A second crystal oscillator is variable (vxo) and injects, after multiplication, 55 MHz into the mixers for both the transmitter and the receiver. Since both of these sections of the transceiver share the same oscillators, they are locked to each other in frequency. What you hear is where you talk, so to speak. This arrangement means never having to worry about being off frequency. To keep the transmitter simple it operates DSB.

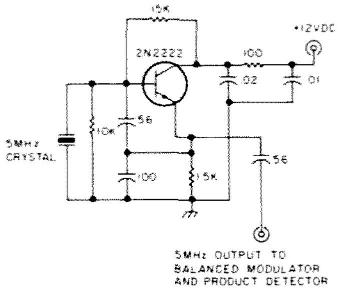


Fig. 3. 5-MHz Colpitts oscillator.

While this is a six-meter transceiver, the circuits and theory can be applied to other frequencies, but this will become obvious later on. See Fig. 1.

DSB Generation

The heart of the transmitter is a Sylvania ECG-973 balanced modulator. This is truly an amazing device. With no tuned circuits and a handful of fixed-value parts, you can construct a DSB source exhibiting better than a 50-dB carrier suppression. I especially like the lack of tuned circuits because it eliminates a lot of tune-up problems. I've used it in a transmitter on 185 kHz, and with the exception of the final amplifier output stage, there was nothing except the carrier balance to tune!

The balanced modulator, 5-MHz oscillator, and audio driver are good starting places for this project. Barring a wiring error, the reward will be immediate: a high-quality 5-MHz DSB signal without tuning a single coil or capacitor (Fig. 2).

The 5-MHz Colpitts oscillator is an old favorite. It will oscillate with practically any crystal. I have built dozens of them and never failed to get one to work. The oscillator, audio driver, and balanced modulator should present no construction or tune-up difficulties. A field-

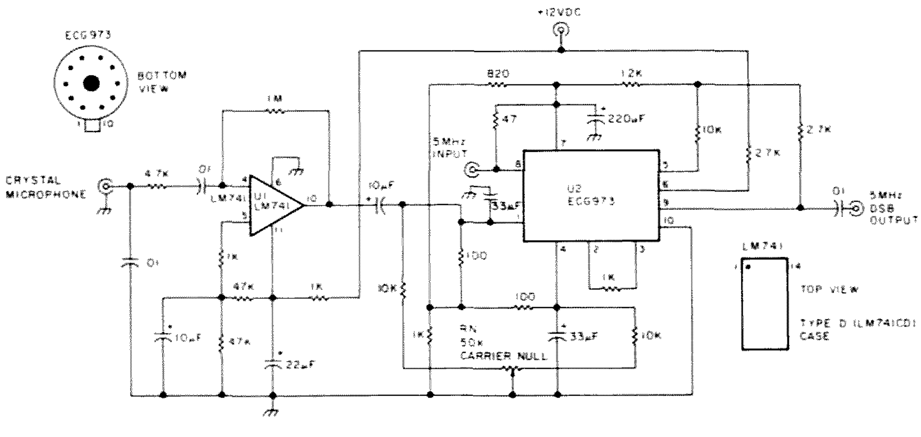


Fig. 2. Audio driver, balanced modulator.

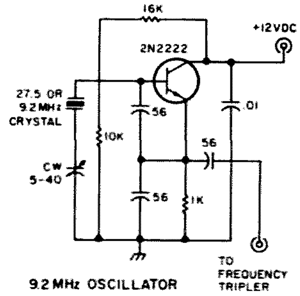


Fig. 4. 9.2-MHz vxo.

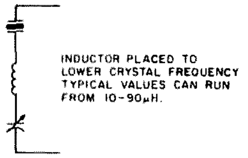


Fig. 5.

strength meter (FSM) can be used to verify both the oscillator output and the DSB coming from the ECG-973. This just about guarantees that everything is right. A double check by listening on 5 MHz will be especially rewarding as you tune through a superbly clean, crisp sideband signal. Only a slight adjustment to R_N will be necessary to null the carrier to better than 50 dB.

At this point some may ask, "Why not filter the DSB and make SSB?" You can, I have, and it works. If you have a crystal filter and change the mixing frequencies accordingly, this will produce a fine SSB generator. Personally I have found almost universal acceptance of DSB on VHF. Most stations have such sharp receivers that they never even

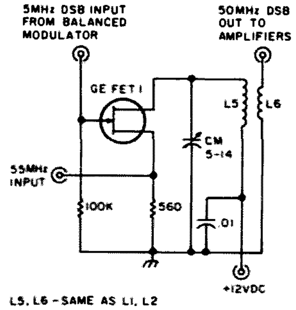


Fig. 7. Transmitting mixer.

detect the other sideband. So unless you tell then you are operating DSB, they will never know. Building crystal filters can be an enlightening (tricky) business, and DSB is so much easier. Why fight?

Construction

The balanced modulator as well as all the other circuits are built on copper-clad glass-epoxy boards. I have learned that it is easier to build and test one stage at a time before proceeding on. Therefore, each circuit section is an individual square of PC board. Revisions occur all too frequently before arriving at a final circuit. This happens even when following a design that is known and proven. I recommend buying the best quality boards available because there is nothing more frustrating than having the copper foil peel away from the cheap PC board which has been heated once too often.

Each circuit section is approximately 2 inches square and these are wired togeth-

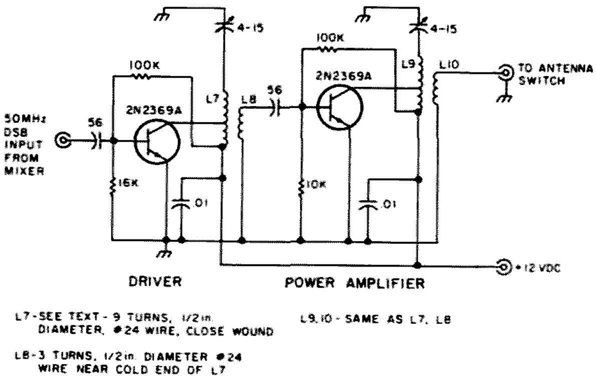


Fig. 8. Driver/power amplifier.

er. Rather than elaborately planning out the wiring routes and component placements as required when etching PC boards, I use an X-acto® knife to cut away the copper foil and establish isolated islands to solder to. The effect isn't much to look at but it is quick, effective, and easily modified.

Vxo and Frequency Multipliers

This variable crystal oscillator (Fig. 4) exacts a cost but returns certain valuable benefits. The cost is the loss of band coverage as compared to a vfo; the benefits are extreme frequency stability when compared to that same vfo. This vxo also uses a Colpitts oscillator, operating at 9.2 MHz. This is multiplied six times to 55

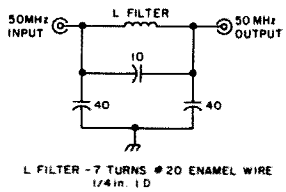


Fig. 9. Transmitting TVI filter.

MHz, which then feeds both the transmitter and receiver mixers. At 9 MHz the oscillator's frequency can be warped about ±6 to 9 kHz by C_W. This comes out to a 40-to-60-kHz swing at 50 MHz.

My own unit operates between 50.105 and 50.160 MHz. The addition of more crystals would mean greater frequency coverage. The nice thing about the vxo is its stability. From a cold

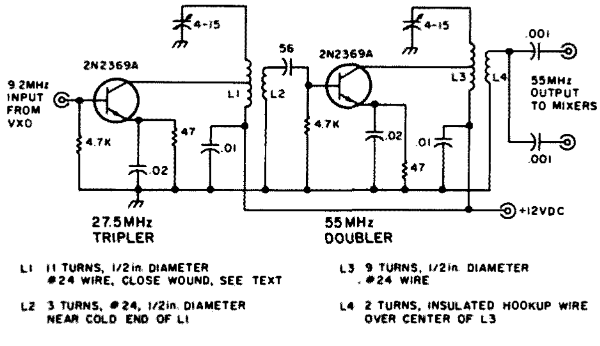


Fig. 6. 9.2-to55-MHz doubler/tripler.

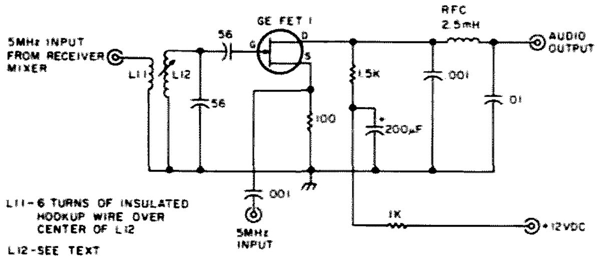


Fig. 10. Product detector.

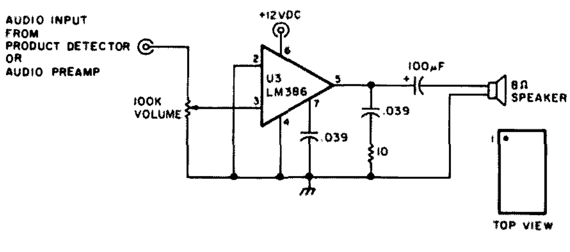


Fig. 11. Audio amplifier.

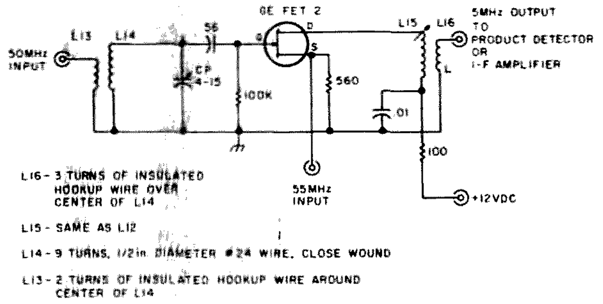


Fig. 12. Receiver mixer.

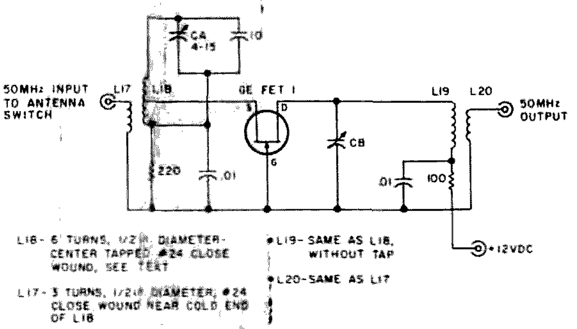


Fig. 13. Rf receiver preamp.

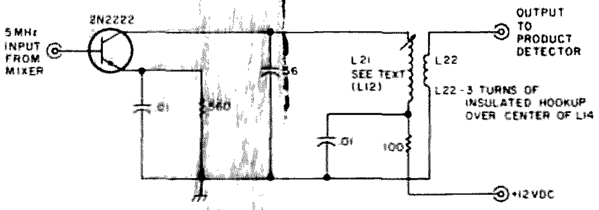


Fig. 14. I-f amplifier.

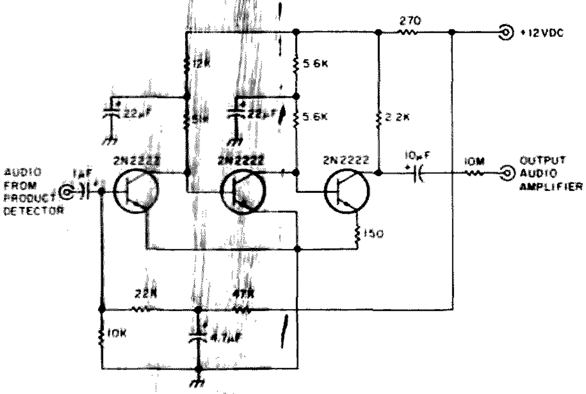


Fig. 15. Receiver audio amplifier.

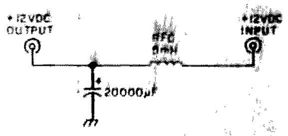


Fig. 16. Power-line filter.

start-up using an unregulated power supply for a test, the vxo did not drift more than 10 Hz over 90 minutes. The crystal I used is a third-overtone type, cut for 27.530 MHz. In this circuit it oscillates on its fundamental frequency, which in this case is about 9.185 MHz. By inserting an inductor (Fig. 5) in series with C_W, the frequency can be lowered to more closely correspond to the true crystal fundamental. The values will have to be experimentally derived. Either overtone or fundamental crystals will work fine in this circuit.

If you are not particularly interested in 50 MHz output and plan to use the output to drive mixers at higher VHF/UHF bands, then CB crystals provide a cheap, easy way to generate rock-stable signals.

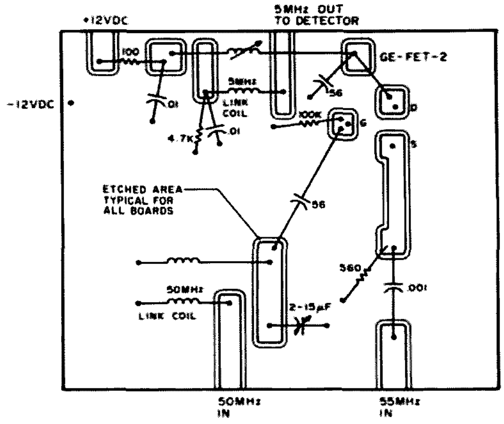


Fig. 17. Receiver mixer board.

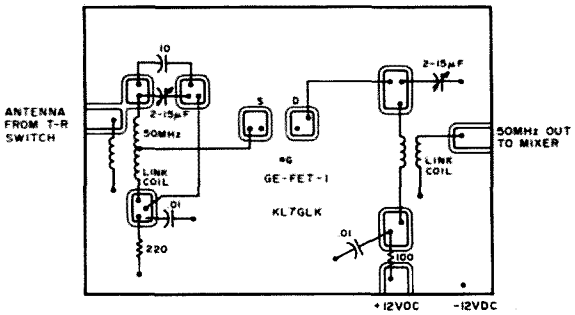


Fig. 18. Receiver rf preamp board.

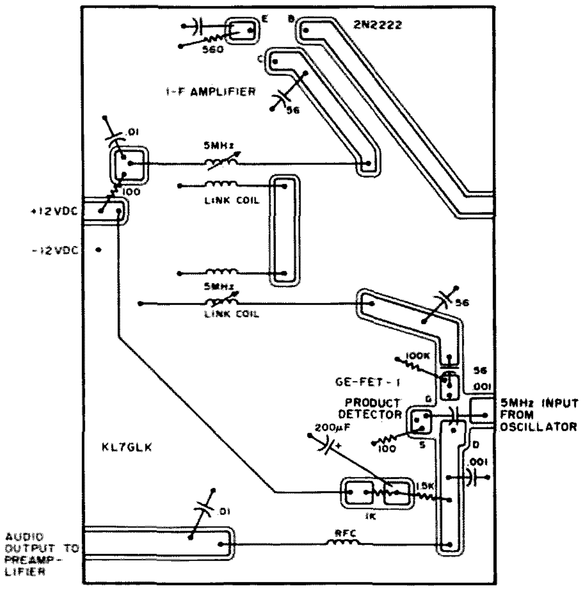


Fig. 19. Receiver i-f amp and product detector board.

It is not until the first multiplier that we reach the first tuned circuits. A grid-dip meter and a frequency counter will ensure 27.5 MHz coming from the tripler in Fig. 6. The following doubler should be checked also to make sure it is passing only 55 MHz. The output coils of these and all the other stages of the transceiver are ½-inch-diameter mini-ductor, 36 turns to the inch. They can be wound freehand if desired. In either case the linking coils are placed near the cold (capacitor-bypassed) end of the tank coil. The tuning capacitors are all Johnson air variables, type T-6-5.

These are nice because they solder vertically to the PC board. I seem to use them by the handfuls for VHF circuits.

Transmitting Mixer

If there is a transmitter stage that can give trouble, it is here. The circuit is straightforward enough, but be careful in tuning it up. Make sure it is 5 and 55 MHz only that appear on the gate and source of the FET and that L_5 is tuned to 50 MHz. Tuning up a transmitting mixer can be confusing because of the presence of the local-oscillator

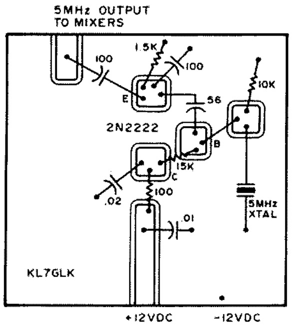


Fig. 20. 5-MHz crystal-oscillator board.

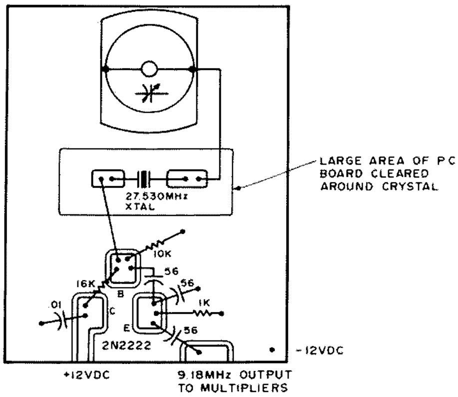


Fig. 21. 9.18-MHz vxo board.

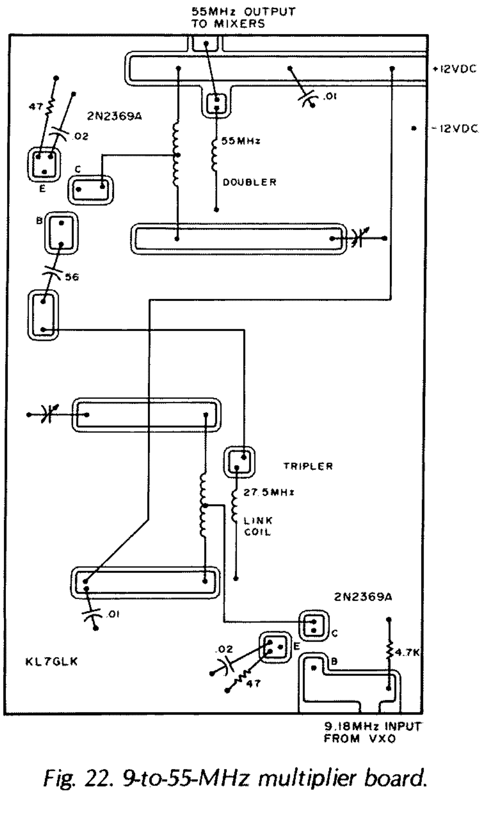


Fig. 22. 9-to-55-MHz multiplier board.

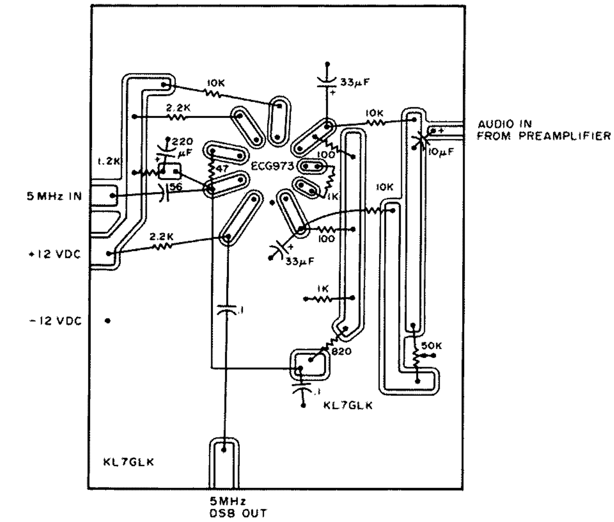


Fig. 23. Transmitter balanced-modulator board.

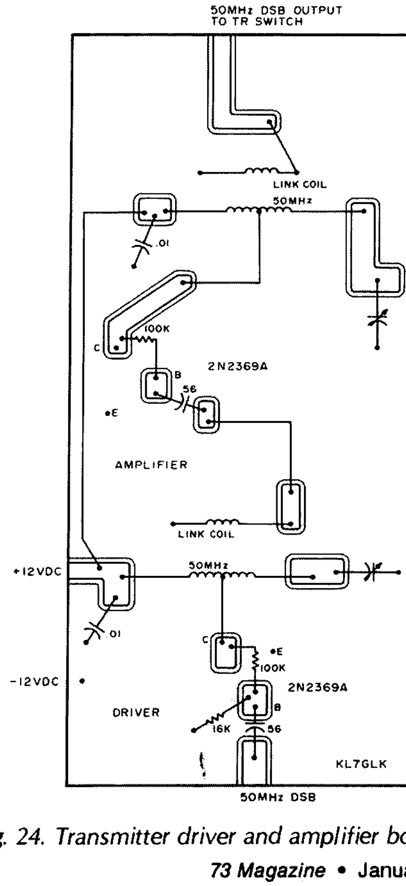


Fig. 24. Transmitter driver and amplifier board.

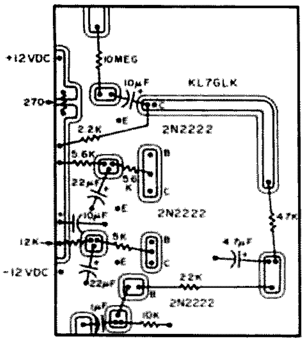


Fig. 25. Microphone/audio driver board.

frequencies. A simple way to optimize the tuning is to listen on a good receiver at 50 MHz. By placing an FSM at the output of the mixer you will get an educational experience in mixer operation at the same time. (Fig. 7).

Attach a microphone to the audio driver but place it so that it will pick up only a minimum of sounds (insulate it by wrapping it in a piece of cloth, etc.). What you want is a low-level white-noise-modulated DSB signal entering the mixer. The mixer stage tunes roughly 45 to 65 MHz so start at the fully-meshed position of C_M. Listen to the receiver, watch both its S-meter and the FSM.

As you tune through C_M's range, you may notice three peaks on the FSM and one good strong peak in noise and S-meter reading on the receiver. Go back to the fully-meshed position and start tuning again. Notice that the first peak you may come to on the FSM does not correspond to a peak on the receiver. This peak is more than likely a weird combination of mixer products, or a fifth harmonic of the vxo. In any case it is not what is wanted. Touch up the tuning on the output stage of the doubler and tripler to minimize this as much as possible, but not to the extent of changing the injection from 55 MHz.

Go on tuning C_M upward until you find an even peak in the receiver S-meter and noise. This is 50 MHz. Notice that the FSM reading has not changed much. There is a lot of rf activity going on inside the mixer. As you can see, an FSM isn't much good for adjusting this stage. Continuing to tune upward will produce a dramatic change in the FSM as it passes through the vxo's 55-MHz output. All this should go to show why it is not a good idea to use a transmitting mixer directly into an antenna. In this tuning procedure we are using the receiver as a selective, sensitive filter which permits observation and adjustment of the mixer at the desired output frequency. An FSM, on the other hand, responds to everything going on inside the mixer. There are more elegant ways to adjust a mixer, but they require expensive equipment and they may not be as sensitive as this simple technique.

Rf Amplifiers

Both the driver and final amplifier stages can be adjusted in a manner similar to that used to adjust the mixer. Again, using only

Parts List

5-MHz Oscillator

1	5.000-MHz crystal	crystal available from Jan Crystals, 2400 Crystal Drive, PO Box 06017, Fort Myers FL 33906
1	2N2222	transistor available from Radio Shack stores
1	100-Ohm, 1/8-Watt resistor	resistors available from Radio Shack stores.
1	1.5k, 1/8-Watt resistor	
1	10k, 1/8-Watt resistor	
1	15k, 1/8-Watt resistor	
1	56-pF silver mica capacitor	capacitors available from Radio Shack stores
1	100-pF silver mica capacitor	
1	0.2-uF ceramic disc capacitor	
1	0.1-uF ceramic disc capacitor	

Balanced Modulator, Audio Driver

1	LM741	Intergrated circuits available from BCD Radio Parts Co., PO Box 119, Richardson TX 75080-0020 (or Radio Shack for 741-386)
1	ECG 973 (MC1496)	
1	47-Ohm, 1/8-Watt resistor	
2	100-Ohm, 1/8-Watt resistors	
1	820-Ohm, 1/8-Watt resistor	
4	1k-Ohm, 1/8-Watt resistors	
1	1.2k-Ohm, 1/8-watt resistor	
2	2.7k-Ohm, 1/8-Watt resistors	
1	4.7k-Ohm, 1/8-Watt resistor	
3	10k-Ohm, 1/8-Watt resistors	
2	47k-Ohm, 1/8-Watt resistors	
1	1-megohm, 1/8-Watt resistor	
1	50k variable resistor (trimpot)	
4	0.1-uF ceramic disc capacitors	
2	10-uF electrolytic capacitors, 15 WV dc	
1	22-uF electrolytic capacitors, 15 WV dc	

Vxo, Multiplier Stages

1	27.530-MHz 3rd-overtone crystal	crystal available from Jan Crystals
1	2N2222	
1	1k, 1/8-Watt resistor	
1	10k, 1/8-Watt resistor	
1	16k, 1/8-Watt resistor	
1	2–25-pF air variable capacitor (Johnson 157-3)	
3	56-pF silver mica capacitors	
2	0.02-uF ceramic disc capacitors	
2	0.01-uF ceramic disc capacitors	
2	2–15-pF variable capacitors (Johnson T-6-5) others are suitable	variable capacitors (Mini-Trimmer #3) available from BCL Radio Parts Co.

Transmitting Mixer

1	GE-FET-1 transistor	
1	56-pF siver mica capacitor	
1	0.001-uF ceramic disc capacitor	
1	0.01-uF ceramic disc capacitor	

white noise into the balanced modulator, these stages are adjusted for maximum output by listening on 50 MHz. This technique allows us to select against any mixer outputs except 50 MHz. Once this is accomplished, an FSM and pilot-lamp bulb across L10 will show output only when you speak into the microphone. Both the driver and final tank coils are fairly selective against passing any 55-MHz energy to the antenna. Once the radio is properly shielded and bypassed, I can get away without a TVI filter. A filter is still a good idea and I've included a simple low-pass design just in case (Fig. 9).

The final amplifier shows no resistor in the emitter lead. Without one, the input power is about half a Watt. By inserting a variable resistor here the input can be varied down to a few milliwatts for those who like real QRP.

Receiver

This receiver's design allows a certain amount of flexibility in its construction. It can be kept simple or expanded as the builder desires. Basically it is an rf amplifier, a mixer, a product detector, and an audio amplifier. 55 MHz mixes with 50; the difference—5 MHz is directly converted to audio by mixing with 5 MHz in the product detector. The audio is then amplified.

Having grown up with the idea that good receivers are supposed to be complex, I still find it difficult to believe anything this simple can work so well.

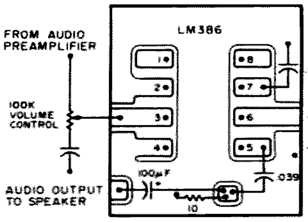


Fig. 26. Receiver audio preamp board.

Product Detector

A product detector is nothing more than a mixer whose output is in the audio range (Fig. 10). L12 is 50 turns of #30 enamel wire, wound on a 3/8-inch-diameter iron-slug-tuned coil. The tune-up of this stage is easy; adjust L12 to 5 MHz with a grid-dip meter. If the audio amplifier (we are stepping ahead a little here) is attached and a longwire antenna is hooked to L11, you should be rewarded with a strong signal from WWV on 5 MHz. Notice that if your oscillator is exactly on 5 MHz, you will hear no beat note with WWV. If not, the frequency difference in Hz (or kHz) will appear as the heterodyne frequency.

Audio Amplifier

You will notice I skipped

1 560-Ohm, 1/8-Watt resistor
1 100k, 1/8-Watt resistor

Drivers and Power Amplifier

2 2N2369A transistors — from BCD Radio Parts Co.
2 56-pF silver mica capacitors
2 0.01-uF ceramic disc capacitors
2 2–15-pF air variable capacitors
1 10k, 1/8-Watt resistor
1 16k, 1/8-Watt resistor
2 100k, 1/8-Watt resistors

Product detector

1 GE-FET-1
1 2.5-mH rfc (choke) — from Radio Shack
1 100-Ohm, 1/8-Watt resistor
1 1k-Ohm, 1/8-Watt resistor
1 1.5k-Ohm, 1/8 Watt resistor
1 56-pF silver mica capacitor
2 0.001-uF ceramic disc capacitors
1 0.01-uF ceramic disc capacitor
1 200-uF electrolytic capacitor 15 WV dc

Audio Amplifier & Preamplifier

3 2N2222
1 LM386 — available from Radio Shack stores
1 10-Ohm, 1/8-Watt resistor
1 150-Ohm, 1/8-Watt resistor
1 270-Ohm, 1/8-Watt resistor
1 2.7k-Ohm, 1/8-Watt resistor
2 5.6k-Ohm, 1/8-Watt resistors
1 10k-Ohm, 1/8-Watt resistor
1 12k-Ohm, 1/8-Watt resistor
1 22k-Ohm, 1/8-Watt resistor
1 47k-Ohm, 1/8-Watt resistor
1 51k-Ohm, 1/8-Watt resistor
1 10-megohm, 1/8-Watt resistor
1 100k variable resistor (trimpot)
2 0.039-uF ceramic disc capacitors
1 1-uF electrolytic capacitor, 15 WV dc
1 4.7-uF electrolytic capacitor, 15 WV dc
2 10-uF electrolytic capacitors, 15 WV dc
2 22-uF electrolytic capacitors, 15 WV dc
1 100-uF electrolytic capacitor, 15 WV dc
1 8-Ohm, 0.5-Watt PM speaker, 3-inch diameter

Receiver Mixer

1 GE-FET-2
1 100-Ohm, 1/8-Watt resistor
1 560-Ohm, 1/8-Watt resistor
1 100k-Ohm, 1/8-Watt resistor
2 56-pF silver mica capacitors
1 0.001-uF ceramic disc capacitor
1 0.01-uF ceramic disc capacitor
1 2–15-pF air variable capacitor (T-6-5)

Receiver Rf Preamplifier

1 GE-FET-1
1 100-Ohm, 1/8-Watt resistor
1 220-Ohm, 1/8-Watt resistor
1 10-pF silver mica capacitor
2 2–15-pF air variable capacitors

Receiver I-f Amplifier

1 2N2222
1 100-Ohm, 1/8-Watt resistor
1 560-Ohm, 1/8-Watt resistor
1 4.7k-Ohm, 1/8-Watt resistor
1 56-pF silver mica capacitor
3 0.1-uF ceramic disc capacitors

Miscellaneous Parts

BNC antenna connector, DPDT switch for T/R, 6" × 5" × 4" aluminum box, miniature microphone jack, and hi-Z microphone.

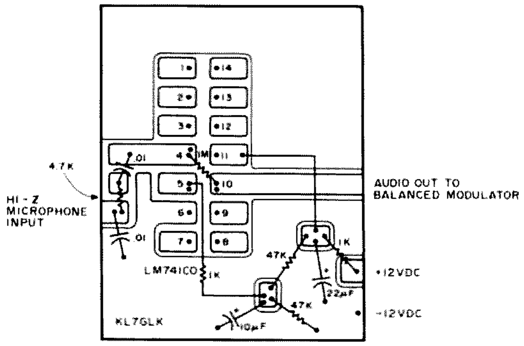


Fig. 27. Receiver audio amplifier board.

a stage, the audio preamplifier. The LM386 will provide enough audio gain to drive a pair of headphones for tuning up the receiver. The preamp can be added later. In fact, if headphones alone are adequate, the preamp can be skipped altogether. With a direct-conversion receiver it is important to have as much gain as possible into the audio section. If the preamp is omitted, place a 10-uF capacitor across pins 1 and 8 to increase the voltage gain from 40 to about 200.

Mixer

The receiver mixer is practically identical to the transmitter. Fortunately it is much simpler to adjust. L15 is identical to L12 and it is dipped for 5 MHz. C_P is peaked for 50 MHz. With 55 MHz on the source, a six-meter signal should now be evidenced as an audio signal. Go back and touch up L12 for the best response with the product detector.

Rf Amplifier

This rf amplifier is a compromise. I traded high gain for stability. When designing this transceiver, one of the things I kept in mind was a design that others could easily build. It is true that higher-gain preamps can be built, but they may require individualized attention to get them stabilized and working properly. This grounded-gate design still offers considerable gain but is rock stable. It will tune up cleanly right from the start. Another can be used for more gain if you wish.

Initially set C_A and C_B to 50 MHz with a grid-dip meter. Apply a six-meter signal, fine adjust the capacitors, and repeak the coils of the mixer and product detector for the best response.

The Basic Receiver

These four stages, the rf preamp, mixer, product detector, and audio amplifier, are essentially the receiver. There was a band opening the evening I completed these stages and I spent several hours just listening to the activity through a set of headphones. There isn't enough audio with this configuration to drive a speaker, so I added an i-f amplifier and an audio preamp.

I-f Amplifier

A single 2N2222 (Fig. 13) increases the audio output some. It also isolates the mixer from the product detector. Originally, I was going to use it to drive a ceramic filter since I feared the selectivity of such a simple receiver couldn't be much. But the more I listened the more I realized just how sharp this little product detector was. I could tune five separate QSOs between 50.110 and 50.120. Sure, they splattered on each other, but when the product detector was locked onto a desired signal, the voice came through sharp and clear. If you want more selectivity, a crystal filter can be added, but believe me, this is a good receiver without one.

Audio Preamp

The i-f stage hasn't enough gain to use a speaker with the LM386 audio amplifier. Direct-conversion receivers require large amounts of audio amplification, thus, they are prone to microphonics. This one is no exception. Be sure to firmly solder everything down on the receiver. The circuits will produce a characteristic ring whenever they are tapped if not securely attached. Fortunately, with the small components used, microphonics should not be a problem.

This preamp (Fig. 15) exhibits a very high gain; I would estimate it to range somewhere around 100 dB. It can drive the daylights out of an LM386 (and your eardrums as well if you use headphones). We now have plenty of gain for room-size-speaker operation, although the three-inch PM speaker I've used doesn't do it credit.

Loose Ends

By now you probably realize that a product detector is not tolerant of a noisy power supply. Voltage regulators that appear quiet for other uses set up a howl when used with this direct-conversion receiver and its high-gain audio stages. Filtering the incoming power lead, the power-line filter in Fig. 16 cures the problem.

Now add some sort of a T/R switch (a DPDT will do) to switch for both the rf and 12-volt functions. You are ready to go on the air.

Where to next? If you have gotten this far you've learned plenty about sideband, mixers, product detectors, and VHF in general. 50 MHz is just the start—see you on the microwaves! ■

SPECIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine *by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices,* 73 Magazine, *Pine St., Peterborough NH 03458.*

OAK PARK MI
JAN 6

The Oak Park ARC will present its annual Swap-'n'-Shop on Sunday, January 6, 1985, from 8:00 am to 3:00 pm, at Oak Park High School. Admission is $2.75 and tables will be available for $8.00. Features will include Novice exams—given at 11:00 am, refreshments, and free parking. Talk-in on 146.52. For more information, send an SASE to Oak Park ARC, c/o Jeff Smith N8FMQ, 459 Madison, Birmingham MI 48008.

SOUTH BEND IN
JAN 6

A hamfest swap and shop will be held on Sunday, January 6, 1985, at the Century Center, downtown on US 33 Oneway North between the St. Joseph Bank Building and the river, South Bend IN. Open tables are $1.00 per foot in a carpeted half-acre room. The Industrial History Museum is in the same building. Four-lane highways lead to the site from all directions. Talk-in on .52/.52, .99/.39, .93/.33, .78/.18, .69/.09, and 145.29. For more information, contact Wayne Werts K9IXU, 1889 Riverside Drive, South Bend IN 46616, or phone (219)-233-3507.

WEST ALLIS WI
JAN 12

The West Allis Radio Amateur Club will sponsor the "Original" Annual Midwinter Swapfest on Saturday, January 12, 1985, beginning at 8:00 am, at the Waukesha County Expo Center Forum (take I-94 to Co. F, south to FT, west to Expo). Admission is $2.00 in advance and $3.00 at the door. Four-foot tables are $3.00 in advance (December 31st deadline) and $4.00 at the door. Food will be available. For tickets, send an SASE to WARAC Swapfest, PO Box 1072, Milwaukee WI 53201.

TUSCALOOSA AL
JAN 12

A special-event station will be held on Saturday, January 12, 1985, commemorating the 63rd anniversary of the Tuscaloosa Jaycees. KE4TN will operate from 1300-2300 UTC on that date and will be offering an 8-1/2" × 11" certificate to all contacts. To receive the certificate, send your QSL card only (no SASE needed) to the Tuscaloosa Jaycees, PO Drawer L, Tuscaloosa AL 35404, or to KE4TN's *Callbook* address.

ISSAQUAH WA
JAN 13

The Issaquah ARC will sponsor the Rats Nest and Crooked Stick QSO Contest, an antenna experimenters' contest and QSO party, on January 13, 1985, from 1800Z to 2300Z. The frequencies will be CW—21.060 to 21.200 MHz, and SSB—21.350 to 21.450 MHz. A Rat Catcher's certificate will be available for anyone contacting three or more IARC members. Exchange your name, QTH, antenna type, IARC membership (Y or N), and send your log by February 1, 1985. For results or more information, send an SASE to IARC, c/o Steve Pack WB7VAS, 4609 158th Avenue SE, Bellevue WA 98006.

RICHMOND VA
JAN 13

The Richmond Amateur Telecommunications Society will sponsor the eighth annual Richmond Frostfest on Sunday, January 13, 1985, from 8:30 am to 3:30 pm, at the Virginia State Fairgrounds. General admission is $4.00. Flea-market spaces are $3.00 without a table and $7.00 with an 8-foot table. Booths with side curtains and backdrops are available to dealers and exhibitors and the building will be open Saturday afternoon for setup (there will be armed security at all times). The entire show will be indoors with no outside tailgating. The deadline for booths is December 30, 1984, and for the flea market January 10, 1985. For more information, write Richmond Frostfest, PO Box 1070, Richmond VA 23208, or call Bill Scruggs N4DDM at (804)-272-8206.

SOUTHFIELD MI
JAN 20

The Southfield High School Amateur Radio Club will sponsor its 20th annual Swap and Shop on January 20, 1985, from 8:00 am to 3:00 pm, at Southfield High School, 24675 Lahser, Southfield MI. Admission is $2.50. Two 8-foot reserved tables are $20.00 and each addtional reserved table is $10.00 (paid in advance). Tables will be available at the door. Doors will open at 6:00 am for exhibitors. There will be plenty of parking and food. All profits go toward electronics scholarships and to support the activities of the Southfield High School Amateur Radio Club. For more information, advance tickets, and/or reservations, write Mr. Robert Younker, Southfield High School, 24675 Lahser, Southfield MI 48034. Indicate with your reservation whether you will need wall space and/or electrical outlets. All table reservations will be confirmed.

SAFFORD AZ
JAN 26

The Eastern Arizona Amateur Radio Society will hold amateur-radio license examinations on Saturday, January 26, 1985, from 9:00 am to 3:00 pm, at the National Guard Armory, 4001 1st Avenue, Safford AZ. Prior to the registration deadline of January 21st, send a completed 610 form, a copy of any license, and $4.00 (registration fee) to EAARS, PO Box 402, Thatcher AZ 85552. For more information, call Richard N7DZH at (602)-428-6560 between 7:00 am and 3:30 pm.

YONKERS NY
JAN 27

The Yonkers Amateur Radio Club will sponsor the Yonkers Electronics Auction on Sunday, January 27, 1985, from 9:00 am to 3:00 pm, at Lemko Hall, 556 Yonkers Avenue, Yonkers NY. Admission for buyers and sellers is $3.00 each; children under 8 will be admitted free. New and used equipment will be auctioned and can be inspected from 9:00 am to 10:00 am. There will be plenty of seats and parking and the auction will start at 10:00 am sharp. Unlimited free coffee will be available all day. The club will charge a 10% commission on the first $100 and 5% on the remainder on successful sales only. Talk-in on 146.265T/146.865R, 440.150T/445.150R, and .52 direct. For more information, write YARC, 53 Hayward Street, Yonkers NY 10704, or phone (914)-969-1053.

HOUGHTON MI
JAN 29–FEB 5

The Michigan Technological University Amateur Radio Club and the Copper Country Radio Amateur Association announces a radio celebration of our winter carnival festivities in the northernmost part of Michigan's Upper Peninsula. A certificate will be issued to all amateurs who make one contact with any participating ham in Copper Country between 0000 UTC January 29, 1985, and 0000 UTC February 5, 1985. Frequencies are 3.630, 7.090, and 14.095 RTTY; 3.705, 7.085, 7.125, 14.085, 21.085, and 28.185 CW; 3.930, 7.285, 14.305, 21.385, and 28.500 phone. (On CW, listen for CQ WC.) Send your QSL and $1.00 to cover postage and handling to Howard Junkin N8FHF, 106 W. South Avenue, Houghton MI 49931.

MANSFIELD OH
FEB 10

The 24th annual Mansfield Midwinter Hamfest/Auction will be held on Sunday, February 10, 1985, beginning at 8:00 am, at the Richland County Fairgrounds, Mansfield OH. Tickets are $3.00 in advance and $4.00 at the door. Tables are $5.00 in advance and $6.00 at the door. Half tables are available. There will be an auction and flea market in large, modern, heated buildings. An ARRL/VEC license exam will be held at the Mansfield Campus of the Ohio State University/North Central Technical College (less than two miles from the hamfest) at 1:00 pm on the day of the hamfest. To take the exam, send an SASE, a 610 form, and a check for $4.00 payable to ARRL/VEC to Lloyd Nelson N8BAZ, 630 Oak Street, Lot 82, Mansfield OH 44907. Talk-in on 146.34/.94. For additional information or advance tickets or tables, send an SASE to Dean Wrasse KB8MG, 1094 Beal Road, Mansfield OH 44905, or phone (419)-589-2415.

MARLBORO MA
FEB 17

The Algonquin ARC will hold its annual electronics flea market on February 17, 1985, at Marlboro Junior High School Cafeteria. Doors will open for sellers' setups at 8:30 am and to the public at 10:00 am. General admission is $1.00; sellers' tables are $7.50 in advance (before February 9th) and $10.00 at the door. Food will be available. Talk-in on .01/.61 and .52. For table reservations or more information, write to AARC, PO Box 258, Marlboro MA 01752.

150TH ANNIVERSARY
SPECIAL EVENT
VICTORIA, AUSTRALIA

A special commemorative callsign, VI3WI, part of the 150th anniversary celebration of the European settlement in Victoria, will be on the DX bands until at least April 30, 1985. VI3WI will be activated on a roster basis by selected members of the Wireless Institute of Australia and its affiliated clubs. All DX bands and all modes will be used and a commemorative QSL is available, either direct or via the VK3 QSL Bureau. A special award certificate is also available for radio contact with Victoria between November, 1984, and April 30, 1985. Contact (SWLs log) one station in VK3 during the award period to qualify. A QSL card for the qualifying contact, endorsed with a congratulatory message on Victoria's 150th anniversary, plus $2.00 or equivalent, should be sent to Victoria 150 Award, Wireless Institute of Australia, 412 Brunswick Street, Fitzroy 3065, Victoria, Australia.

✓ See List of Advertisers on page 80

REVIEW

REGENCY HX1000

Regency Electronics, Inc., has finally made available their long-awaited model HX1000, a hand-held automatic keyboard-programmable 30-channel, six-band monitor receiver. Rather than racing other manufacturers to be "first on the market," Regency has taken their time and produced a quality portable FM scanning receiver which surpasses any I've seen.

Physical Description

The Regency HX1000 is a double-conversion superheterodyne scanner designed to receive narrowband-FM communications in the amateur, public-safety, and land-mobile bands at 30–50, 144–174, and 440–512 MHz. Its microprocessor-controlled circuitry permits keyboard entry of frequencies into 30 channels to be scanned, either individually or in any combination.

At first glance, even a seasoned operator could be fooled into thinking the Regency is a portable transceiver. The radio is housed in a case closely resembling a handie-talkie in virtually every aspect. Measuring 2-3/4" × 7-3/4" × 1-9/10" and weighing approximately 1¼ pounds, the HX1000 has the feel of a conventional hand-held transceiver.

All frequency entries and status information are visible on the liquid-crystal display (LCD) on the center of the front panel.

Immediately below the LCD is the 16-key keyboard used to program and control the scanner. Along the bottom of the keyboard are slide switches for priority scanning and the night-display lamp.

Atop the scanner are found on-off/volume and squelch controls, a BNC connector, and a miniature jack with an attached dust cover.

A jack for an external nicad wall charger is on the bottom of the unit, as are contacts for a drop-in charger, available from Regency as an accessory.

The Regency HX1000 hand-held scanner.

In a departure from the Regency "made-in-America" tradition, the HX1000 is manufactured in Japan. However, this in no way detracts from Regency's reputation for quality.

The scanner comes handsomely packaged and is complete with such accessories as a nicad battery pack and connector cable, a plug-in wall charger, earphones, and a rubber helical antenna.

Operation

Operation is simple and easily learned. Upon removal from the shipping package, the user need only install the rubber helical antenna on the BNC connector and the battery pack in the compartment on the rear, and you're ready to begin programming.

Frequency programming into the 30 channels is accomplished in the manual mode by first keying in the frequency in megahertz, pressing Enter, and then keying in the channel number to which the frequency is to be entered (e.g., 01, 07, 24, etc.). The frequency is now entered into the selected channel unless the Error display appears, indicating that the intended frequency is outside the vco-lock range.

Once 30 frequencies (or any lesser number, according to the user's needs) have been entered, they will remain in the scanner's memory until reprogrammed or until the battery is disconnected. In order to automatically sample the channels entered, the Scan key is pressed. Whenever activity is located, the scanner will stop on that channel and monitor until the transmission ceases, then resume scanning.

In addition to functioning as a scanning receiver, the HX1000 can also search any selected frequency range within a band for active frequencies. Searching is keyboard-programmable using the Search Prog key to open the memory, and the Lower and Upper keys to enter the desired search limits, which are preserved in memory until changed. Search limits are retained when the unit is turned off. Searching is initiated with the Search Scan key and proceeds to check for activity on all frequencies between the lower and upper limits.

Searching is completed at a rate of approximately 17 seconds per megahertz on VHF and eight seconds per megahertz on UHF. When activity is located, the unit either remains on the frequency for four seconds (in the Search-Delay mode), or remains stopped indefinitely pending a keyboard command to proceed (in the Search-Hold mode). Frequencies located while searching may, if desired, be stored directly in one of the unit's 30 channels.

In the event that an extremely strong signal causes the search to stop on a frequency immediately before or after the actual carrier frequency, one-step frequency increment keys are provided to move the searching upward or downward one step at a time. With the squelch fully open, these keys may be used to manually step up or down from a frequency during searching, and will step continuously at a slow rate while depressed.

On the VHF bands, frequencies are programmable in increments of 5 kHz, and in increments of 12.5 kHz on UHF, with corresponding search steps.

As a battery-conservation feature, the LCD clock has a switch, located inside the battery compartment, which can either be set to furnish power to the clock at all times, or only when the scanner is turned on. In the latter position the clock must be reprogrammed each time the scanner is turned on in order to maintain correct time.

Each time a key is pressed, a beep is heard, verifying the entry. This beep is audible only through the earphones when this accessory is used. It cannot be silenced.

Priority scanning of channel one is controlled by a front-mounted slide switch. The scanner samples the frequency in channel one once every two seconds and switches to it if activity is noted. When scanning a number of channels or listening to a lengthy transmission, this feature can be quite handy to keep tabs on a local repeater or emergency frequency. This feature functions in the manual mode as well.

Selectable scan-delay is available, covering all channels. This delay keeps the scanning action stopped for two seconds on the channel after transmissions cease.

The LCD is multi-functional, displaying not only the frequency in megahertz but also the channel number, and indicates whether priority is engaged and if scan-delay and channel lockout are present. Also, it shows "Batt" when recharging of the nicad pack is necessary, and also serves as the clock display.

To facilitate night viewing there is a display back light, incorporating a battery-conservation feature which discontinues power to the lamp if it is left on for more than 20 seconds. This light is more than just a novelty; it not only illuminates the display at night, but also provides sufficient light to operate the keyboard.

A leather carrying case is supplied which has an opening to access the wall-charger jack and a transparent plastic covering over the keyboard. This permits keyboard operation with the case on while protecting keys from dust and moisture. A sturdy metal belt clip is also included and may be used with or without the leather carrying case. The clip is installed with two Phillips-head screws onto the back of the scanner, and it is necessary to remove these screws each time you want to remove or replace the carrying case (the screws go through the leather case and into the back of the scanner). This can create a problem when it's necessary to reset the microprocessor, as you have to remove the belt clip to remove the carrying case to access the battery compartment and switch.

Upon inspection of the circuitry, one finds that the compact complexity of the HX1000 is made possible by stacking the PC boards atop one another. The rf package is on the board immediately visible when the back cover is removed. Concealed behind this are the programming-logic and synthesizer boards, connected to the keyboard and the rf board via jumper wires.

Examining the boards, I noted that all are connected with brass spacers to the die-cast aluminum chassis. This makes the boards somewhat more vulnerable to damage due to physical shock to the outer case and, combined with the glass of the LCD, underlines the importance of using care in handling.

User Comments

Upon examining the HX1000 and comparing it to other synthesized hand-held, base, and mobile scanning receivers, I find that it excels in both the quality of the scanner's construction, sensitivity, and clarity of audio. All operational characteristics either meet or exceed those listed in the owner's manual, and the keyboard configuration and programming sequence are easy to learn and remember.

In searching across the bands, remarkably few birdie frequencies were encountered—an unusual observation with a newly-introduced scanner.

The LCD readout is highly visible under various lighting conditions when viewed straight on and provides enough information to the user without adding any unnecessary and confusing graphics.

According to specs published in the owner's manual and sales advertisements, the HX1000 covers ranges of 30–50, 144–174, and 440–512 MHz (subdivided by Regency into six bands). The manual states that should you attempt to enter an out-of-band frequency, "Error" will be displayed. However, this display is apparently triggered only when the vco fails to lock, and not upon recognition of an illegal keyboard entry. Thus, it is possible to enter frequencies far outside the listed ranges. My unit was able to be programmed to search and scan from 25–60, 116–190, and 305–530 MHz! While different radios will be able to cover slightly different frequency extremes due to manufacturing tolerances, it is a safe assumption that most units should be able to cover at least 5 MHz above and below the published band limits.

Note that the radio was designed to operate at maximum sensitivity only within the standard bands, and when venturing farther from the regular band limits a corresponding decrease in sensitivity will be noted. Even so, signals on 10- and 6-meter FM and in the 410–420-MHz range were as readable as regular channels on VHF-low and UHF, respectively.

This coverage of frequency ranges outside the regular bands including 6 and 10 meters, added to the regular 2-meter and 440–450-MHz coverage, makes the HX1000 a super low-cost synthesized receiver for amateur VHF/UHF FM communications. With 30 channels at your fingertips, there is more than ample memory capacity to store your favorite repeater or simplex frequencies.

The nicad wall charger supplies the scanner's appetite for 200 mA of charging current (this is the value marked on the charger, and differs from the value of 100 mA specified in the owner's manual). However, the powerful battery doesn't have to spend much time in the charger before it's ready to go.

The scanner exhibits excellent sensitivity, clearly pulling in Ohio stations at the author's home near Pittsburgh PA, while both nearby base and mobile "brand name" scanners on the same frequency showed no evidence of a received signal with squelch fully open! Further, there was no evidence of intermodulation interference under most conditions (certainly superior to several other synthesized units I've tried). Selectivity was also excellent. Sensitivity is rated at 0.5 uV on VHF and 0.7 uV on UHF, both as measured at tune-up, 12 dB Sinad. Selectivity is down 6 dB at ± 7.5 kHz and down 50 dB at ± 18 kHz.

The rubber helical antenna supplied with the scanner provides very good reception compared to other portable scanner antennas. Nevertheless, one is tempted to attach an external antenna to the top-mounted BNC connector in an effort to further improve reception (particularly if using the HX1000 as a mobile scanner). Regency cautions against this, however, stating that other antennas may cause improper impedance matching and may cause "reduction in effective receiving range, increase of spurious radiation, and excessive battery drain." No antenna impedance rating is listed in the specs. Still, one is tempted to experiment.

To facilitate easy operation of the HX1000, the owner's manual is well written and contains complete and concise operating instructions.

Regency's suggested list price for the HX1000 is $329.95, but various mail-order firms specializing in scanners have been selling the unit for between $206 and $250 plus shipping.

Conclusion

The Regency HX1000 is a superior receiver which makes a handy addition to any shack. Its portability and performance make it a truly useful receiver for emergency operations and for monitoring VHF/UHF amateur and public-safety systems, exceeding the capabilities of many contemporary base and mobile scanners. Of all the scanners I have owned, the HX1000 is among the best in price, performance, and versatility.

For additional information, contact *Regency Electronics, Inc., 7707 Records St., Indianapolis IN 46226-9989; (317)-545-4281.* Reader Service number 485.

Louis Smith II N3BAH
Latrobe PA

MINI JINI AND THE ORGANIZED HAMSHACK

Pity your poor reviewer! I'm absolutely buried under new software packages for use with home computers in the ham shack. I know, it's not a pretty sight.

I doubt that I'll get much sympathy for my situation. After all, it is fun getting to try out new products. Sometimes, though, it becomes tiresome, seeing the tenth software package to do the same thing. It's particularly trying when the instuctions are unclear, the program is poorly written, and the results just don't seem worth it.

That's the way this particular Sunday afternoon was going until Mini Jini rose to the top of the stack!

First of all, I didn't even have to load the program. It comes on a plug-in cartridge for the VIC-20 and C-64 computers. Then, I didn't even have to tell it to run. When I turned on my machine, like magic the credit page and then a menu appeared.

Weary from trying to decipher instruction manuals that didn't tell me what I needed to know, I approached Mini Jini expecting more of the same. Jini Micro Systems advertises this package as being written in plain, simple English. That advertising claim turned out to be absolutely on the mark!

A forty-page instruction manual comes with Mini Jini, but it doesn't really take very long to read the simple instructions and go through the examples provided. I also found the instructions well indexed, a definite plus for any instruction book.

What is Mini Jini? In two words, it is a record keeper. What? No fancy terms like data base or electronic spreadsheet? Not for Mini Jini. Remember, it's written in English!

In computer terms, Mini Jini is a data base and offers the features you would expect to find in such a program. It will let you keep a top-notch logbook, track your QSL cards, record progress towards awards, or serve as a foreign phrase book. If you must have a non-ham reason for buying it, you can generate financial statements, keep an inventory of your household goods, or track junior's academic progress . . . all with the same program!

The main menu for Mini Jini lets you create, look through, order (alphabetize), search, or fix a file. You can print the information to the screen or a printer. Additionally, you can save and load files you create to disk or tape.

If that's not enough, a feature called math pack allows you to do calculations on the different entries in your number files.

Mini Jini makes efficient use of memory space. The Commodore 64 version has a capacity of 500 45-character records with four fields or less. A fully expanded VIC-20 allows a similar number of records.

There are many logbook programs on the market. Some of them are quite good. Almost all of them are considerably less expensive than Mini Jini. So why buy this program?

In most cases, logbook programs are exactly that and can't do anything else. In their favor, many of them provide beam headings, DX prefixes, zones, and other information that Mini Jini does not. If you are inclined to create them, Mini Jini can handle all of these functions and a lot more. With the dedicated systems, you are stuck with the limitations of the program.

Creating files on Mini Jini is just as easy as falling off a log. If you are really lazy, the Organized Hamshack series of overlays is available for $12.00 (disk) and $9.00 (cassette) to complement Mini Jini in the ham shack. The overlays (another one of those new-fangled computer words) provide 13 different file types for you to use, including a logbook (one in English and one in Spanish!), a DXCC log, a ham station inventory, and a mailing list.

One of the more unique files included is a "Ham DXtionary," so you can cross-reference frequently used foreign phrases.

The overlays, particularly ones like the DXtionary, would be much more impressive if they actually included a good number of useful entries. Only the format is provided, however, with one or two examples. Understand that for the price, I don't consider this a shortcoming, only a suggestion for a possible addition to the product line!

Mini Jini, at $49.95, is a full-featured record keeper. It will take care of the club mailing list for you, organize your emergency call-out lists, allow you to have virtually "instant memory" while on the air, and help you figure your taxes at the end of the year. Incidentally, the files created by Mini Jini are compatible with several word-processing packages such as Wordpro and Papermate.

Mini Jini is available through *Fox Tango Corporation, Box 15944, West Palm Beach FL 33406; (305)-683-9587.* Reader Service number 481.

Jim Grubbs K9EI
Springfield IL

AEA's TI-1 tuning indicator.

AEA'S TI-1

Here's a new station accessory that you ought to know about, especially if you're a RTTY enthusiast and don't happen to have a scope to tune in those narrow-, medium-, and wide-shift signals. The TI-1 is a tuning indicator (bet you guessed that already) that can help easily and quickly tune your receiver to the exact frequency for decoding RTTY/AMTOR and ASCII.

You will need a source of 12 volts dc at just a few mils to power it, and you'll need a patch cord and a couple of 3.5-mm plugs to connect the TI-1 to your interface (or your receiver, depending upon the particular hookup you have). That's all there is to it. In my own case, I hooked the audio from the receiver through the TI-1 and into the AEA MicroAmtor interface . . . simple in/out.

There is a switch on top that allows you to select 170-Hz, 425-Hz, and 850-Hz shifts, and there is an internal speaker if you want or need it (the speaker can be switched on and off).

The tuning operation is simplicity itself. On the top of the box is an LED strip in which the LEDs occupy a "window" about 2 inches wide and 1/2 inch high. When the TI-1 is turned on, you don't see much of a display until you tune across a signal, and then it's really impressive. The mark and space tones light up the LED—and you can actually see the separation. Very bright at the mark and space locations, shading off to a duller red in between. To properly tune the signal, line up the bright mark and space tones with the respective "pips" on the box just underneath the window. Believe it or not, they exactly fit, and when the mark LED is brightest and lined up exactly on the mark pip, you have exact frequency tuning.

Just for fun, I tried some different widths and switched the filters in and out so that I could watch the signals spread and narrow, depending on which tone pair I was tuned to.

Just in case you can't remember which frequency is which, just look at the box—it's all there in white numbers on black crackle: 2125 at the low end; 2295, 2550, and 2975 at the high end. In between, you see the shift widths, just so you can't forget: 170, 425, and 850 cycles.

My impression of all this was that this is a really neat, useful, and simple device that can make RTTY tuning a snap for anyone. I wouldn't hesitate to recommend it, and it doesn't seem possible that even a scope and the crossed lines could more accurately or easily tune in the RTTY frequency shifts.

For more information, contact *Advanced Electronic Applications, Inc., PO Box C-2160, Lynnwood WA 98036; (206)-775-7373.*

Jim Gray W1XU
73 Staff

DX

Chod Harris VP2ML
Box 4881
Santa Rosa CA 95402

DXING ON THE LOW BANDS

The Federal Communications Commission (FCC) finally dropped the other shoe in its proposed expansion of the phone subbands. This process began in 1982 when the FCC suggested increasing the phone frequencies on 20 meters. When they did grant additional phone spectrum, the FCC mentioned they were looking at expanding the other high-frequency phone subbands as well. So, on September 1, 1984, General and higher-class licensees gained new phone frequencies.

In case you have been living in a cave the past few months and haven't heard about the changes, here are the new frequencies:

Extra-class operators gain 3750-3775 and 21,200-21,250. Advanced-class ops can now use phone on the new subbands of 3775-3800 and 21,225-21,270. Generals gain access to 3850-3890 and 21,300-21,350. All three classes get new phone frequencies on 10 meters: 28,300-28,500. Of course, all these changes are in *addition* to the previously existing phone subbands.

With the declining sunspots, the effect of the increased phone frequencies on the 10- and 15-meter bands won't be very obvious for a few years. 10 meters has always enjoyed ample phone spectrum, even at the peak of the sunspot cycle. Also, most rigs have the frequencies below 28,500 on a separate band from the commonly used region between 28,500 and 28,700. I would suspect that the new phone subband on 10 won't have much effect on DXers. Perhaps some of the localized communications and nets will leave the more heavily used frequencies for this new subband. We'll have to wait and see.

The expansion of the 15-meter phone band will have some immediate effect on DXers and DXing, an effect which will grow in importance as the sunspots again make 15 a worldwide band. The extra 50 kHz which the Extras gained is prime DXing country. Much of the worldwide phone

DX activity takes place between 21,200 and 21,300 on 15 meters, and now US Extras have twice as much subband in which to stalk the elusive DX operator. The 45 kHz the Advanced-class DXer gained is again very prime DX territory.

Of all the increases in the subbands, however, the most important is the new 25-kHz segment on 75 meters which the Advanced operators now enjoy. The Extras gained the same amount of subband, and the Generals were rewarded with 50 kHz also, but the new frequencies will have the most impact on Advanced DXers.

The reason the Advanced DXer is the real winner in this phone subband expansion is the "DX Window" on 75 meters: 3775-3800. As any phone operator who has listened to 75 meters can tell you, 90% of all the phone DX on 75 meters is within this window or just below it. Seldom does one hear much DX above 3800. As a result, phone DXers with Advanced licenses had been just about frozen out of 75 meters—until now.

The primary reason DX stations congregate in the 3775-3800 window is international amateur frequency allocations. Only in International Telecommunications Union (ITU) Region 2 (North and South America) are amateurs allowed to operate up to 4000 kHz on 75 meters. Region 1 amateurs (Europe and Africa) cannot use 75 above 3800. In fact, the interference levels above 3800 are so bad in many places in Region 1 that even *listening* for amateur stations above that frequency is a waste of time. So DXers have a very limited overlap of phone frequencies on 75 meters.

So Advanced-class phone DXers have won a real plum: access to the best 25 kHz in the entire 75-meter phone subband! This, coupled with the declining higher-frequency propagation which pushes DXers off 15 and 20 meters, means much more activity in low-band DXing. Let's look at some of the thrills and frustrations involved in DXing on the lower frequencies, and some of the ways around them.

Many hams associate DX with 20 meters, and then 10 and 15. Relatively few amateurs think seriously about DXing on 40 and 80 (much less 160 meters!). Why is this? Three main factors keep the majority of DXers off 40 and 80 meters: too much noise, weak signals, and the need to work split (on phone). We'll see how you can handle each of the stumbling blocks, without investing in a three-element, rotatable 80-meter yagi.

Combating Noise

The only time 75 meters is quiet is when *it's not open*. Newcomers to the band are quickly disheartened by the unbelievably high QRN levels, especially in the summer. How can anyone hear DX signals between 40-over-9 static crashes? Even in the dead of winter, the interference level can be murder. And built-in noise blankers seem to provide little relief.

The solution to the problem of noise is simple: you need a poor antenna. That's right, a lousy, high-loss antenna. The worse your antenna, the less noise you receive. With a good dummy load (which makes a pretty bad antenna), you won't hear any noise at all. Of course, you won't hear any DX either. What you need is an antenna which only receives DX, and not the noise.

Since nobody has seen fit to invent one yet, we have to settle for an antenna which only receives in one or two directions. Here comes that 3-element beam, you say. But you don't need the beam. Remember, we were looking for a poor antenna, not a good one. Lousy, directional antennas for 80 meters include Beverage antennas and loops.

The Beverage antenna is simply a very long wire stretched a few feet off the ground, aimed in the direction you want to hear. The longer the wire, the more directional the antenna. At least a few hundred feet helps on 80, and a quarter-mile is great! The Beverage doesn't have to be anything fancy. A roll of transformer wire hanging from bushes and tree limbs works fine. Take care to keep the wire above head level in high-traffic areas. You can run the wire along wooden fences—it doesn't have to be exactly straight to be effective. Since the antenna is only used for *receiving* (see below), there is no need for any insulators.

An alternative to the Beverage for the DXer who simply can't stretch out a quarter-mile of wire is the loop antenna. Check the various handbooks and antenna books for details.

Both the loop and the (unterminated) Beverage are bi-directional antennas: They receive relatively well in two opposite directions and very poorly in others. The loop works best broadside to the loop, while the Beverage works best along the axis of the antenna. Since the noise on the lower bands comes from all different directions, these antennas greatly reduce the level of received noise. They only hear noise in the same direction as the signal, which is only a fraction of the total.

Two precautions with either antenna: They are receiving antennas *only*, and neither antenna will provide much in the way of received signal strength from the DX station. Since these antennas can only *be* used for *receiving*, you must find some way to prevent accidental transmissions into the antenna. Some full-feature transceivers have an external receive-only antenna jack somewhere. Check the transverter jack for such a connection if there is no obvious jack. If you try to rely on manually switching between a receiving and a transmitting antenna, you will "cook" your loop or Beverage while trying to work a rare one. Install either a simple relay circuit or an automatic switch if you can't work out an internal connection to the transceiver. Of course, owners of separate receivers and transmitters have no problem "smoking" their receive-only antenna.

The final difficulty with Beverage and loop antennas is the poor signal strength such lousy antennas provide to your receiver. You may well find you need a preamplifier in the line to boost the DX signal to a readable level. Again, make certain there is absolutely no way you can transmit into your preamp, or someday you will!

Dealing with the Weak Signals

The same preamp which compensates for the losses of the receiving antenna will help overcome the handicap of the poor signal strengths of the DX station. However, a preamp won't do *your* signal any good. Weak signals simply don't hack it on 80 meters, and transmitting amplifiers are definitely the norm. Even a good amplifier is not enough to be loud on 80—you also need an effective antenna to work DX.

The secret to an effective DX antenna on the lower frequencies is low-angle radiation. That is, radio signals traveling parallel to the ground and not straight up. Many amateurs use a relatively low dipole for 40 and 80 meters. While excellent for local, short-range communications, such a low dipole is one of the poorest choices for DX. A glance at almost any antenna book will show the cause: at low heights above the ground, dipoles radiate almost straight up. All of your signal goes straight up and straight down, and little goes off toward the faraway DX station. You need an antenna which concentrates more rf in the lower angles for better long-distance communications.

What kind of antenna does this, besides the three-element beam? A high dipole will work, as will a vertical over a good ground. By "high" I mean high in terms of wavelength: a minimum of one-half wave high. That's about 130' on 75 meters. That's high! Since most of us don't have two 130'-high supports in our backyard, we pass over dipoles for DX on the *low bands*.

Verticals *theoretically* radiate much of their rf at very low angles. However, those nice charts in the antenna books are based on a *perfectly conducting ground*, not those two radials you managed to sneak into your yard. The worse the ground, the less low-angle radiation escapes from your vertical. Again, a "good" ground is something completely out of the question for many amateurs. To get good low-angle radiation from a vertical requires 120 one-half-wavelength radials, a circle 280' in diameter with *3 miles* of wire!

Not many DXers have *that* much dedication to the hobby. Fortunately for the rest of us, any radials will help, and the more the merrier. Even doubling the number of radials from 2 to 4 will make a difference. As with the Beverage, the radials don't have to be exactly straight—just string them out wherever you can.

Some amateurs are more serious about their grounding system. 9L1CA covered his entire front lawn with criss-crossed wires before seeding. The lawn grew up over the wires and the system worked splendidly with a pair of 80-meter loaded verticals. And one southern-California 80-meter DXer still laments "the one that got away" when he had rolled up his chicken-wire grounding system to mow the lawn.

For DXers fortunate enough to have a tower for the high-frequency antennas, several antennas will provide better results *than* a simple *inverted vee* on the low bands. Many hams have had very good success with sloper antennas. These very simple antennas are single wires running from near the top of the tower (where the coax shield is grounded to the tower) out in the direction of the DX. Little tuning is required. In some cases this sloper will provide good low-angle radiation and good DXing. Switchable slopers in different directions can cover the world.

Another antenna for hams with a tower is a *half-wavelength loop* antenna, with the peak hung from near the top of the tower. You can stretch out the loop facing the direction you desire and feed it in one corner. The loop is more broadbanded than the sloper, but it requires more real estate. Both antennas are simple, easy to build and use, and well worth the effort for the low-band DXer.

When and Where

Okay, we've got a good receiving antenna up and running and our transmitting antenna has good low-angle radiation. Now how do we find DX on the low bands? The best time to find DX on 40 and 80 meters is when the maximum usable frequency (MUF) is just above those bands. When the MUF is very high, above 14 MHz, the low bands are washed out with absorption. Only at night do 40 and 80 provide good DX possibilities. In fact, one of the best times to look for DX is just before and during local sunrise. Sunset is the time to look for DX to the east. In the wee hours of the morning, local time, when few nearby stations are on the air, is another prime time for low-band DX. (I will talk more about sunrise, sunset and the grey line in a future column.)

As to *where* to look, you have to pay attention to international frequency allocations outside the United States. While you can work some "local" DX, such as the Caribbean, on frequencies above 3800, most long-haul 75-meter DX hovers around 3775-3800.

On 40 meters, the international allocations outside North and South America limit amateurs to frequencies below 7100. Thus, on phone you must listen in the 7050-7100 range for DX stations on phone. Those stations will announce "listening frequencies," such as, "listening on 7183."

You, of course, cannot transmit phone on 7060, or wherever the DX station is. Even if you could, he isn't listening on that frequency, so it would be a waste of time to call him there. (But that doesn't seem to stop people from trying, or others from griping about the practice.) You must transmit on 7183, or thereabouts, while listening at 7060. Sometimes the same situation applies on 75, where the DX station is well below the US phone subbands. Russians, for example, can often be found around 3642, a "hole" in the very heavy 80-meter interference in that part of the world.

Working Split

You need to be able to transmit on one frequency while listening to another. Most rigs let you do this over a limited frequency range. It's called RIT or clarifier, or some such name. But the frequency splits on 40- and 80-meter phone are far outside the range of your RIT.

You can try spinning the dial back and forth between the two frequencies, but the chances of this working are not good. More likely, you'll end up transmitting out of the stateside phone band, and have half the world yelling at you.

Far better is a second receiver, or extra vfo, or one of the fancy new rigs with all kinds of memories and programs to handle "working split." Ideally, you want to be able to listen to *both* the DX frequency and the one on which you are sending, so the second receiver is the best solution. It doesn't have to be anything fancy; almost any halfway decent amateur receiver will do, especially with a directional antenna and preamplifier.

If you use a memory switch or extra vfo to split your transmit frequency from your receive frequency, use the fixed frequency on the DX station and tune your transmitting frequency. The DX station is not going anywhere, as he isn't even listening to the frequency on which he is sending. (Actually, he relies on the stations he is working to tell him if his transmit frequency remains clear.) So lock the fixed frequency on the DX station and then tune your transmitting frequency in the range given by the DX station.

If he sends "listening 7183," you tune around 7183 and call him. Don't bother to send *his* call, just send yours. Listen down below 7100 for his reply. If you can, also listen to his listening frequency for the station the DX station last worked. If you can transmit on the same frequency as the last station worked, you stand an excellent chance of being next in the pileup. And the only way you can do this is if you can listen to your transmit frequency.

The proper procedure takes some finesse. The trick is to listen to *both* the DX station and your own transmitting frequency at the same time. While the DX station is listening *for his report*, you tune around the listening frequency for the sta-

tion giving the report, the station in contact with the DX station. You won't find him right away, and sometimes the DX station will tune away soon after the contact, but with practice and perseverance, you'll locate the other station. Zero-beat your rig on that frequency.

Then, when the DX station says, "QRZ," you jump in with your call. You know the DX station is listening on that frequency; he just finished a contact there. If your timing is good, bang!, another new one in the log!

A good example of how important this technique can be was seen in Ron Wright's DXpedition to the Kermadec Islands last March. On CW Ron *said* he was "listening up," as is common practice. Actually, Ron worked many stations *below* his transmitting frequency. The only way to know this is to listen to both Ron and the station he is working. Once you note that he is working stations *below* his transmitting frequency, you can zero-beat the last station worked and call Ron. Without the ability to listen to your own transmitting frequency, your chances of working Ron were significantly reduced.

With these hints in mind, you should be able to work your share of DX on the low bands during the winter. DXing on 40 and 80 meters is not for everyone. It is not an after-dinner activity. It means going to bed after dinner and getting up in the middle of the night to pick through static and interference, and probably hear nothing at all. On the other hand, some nights 75 meters provides some of the most exciting and satisfying hours of DX. Most of my fondest memories of DX are of late nights when "the band was open" on 75: working dozens of rare Russian republics as the sun rose over Asia, giving scores of "peanut whistles" their first DX on 75 in a late-night WAS net, working Europeans from the Galapagos, with YS9RVE as emcee, and many more episodes.

So give 40 and 80 a try. Next time we'll discuss some of the ways you can listen to both your own frequency and the DX station at the same time! Stay tuned.

LETTERS

SPECTRUM LOSS

In reading your September commentary on the Morse-code requirements, technology, and the future, a thought occurred to me. If many areas of the USA are not utilizing the spectrum above 450 MHz, and we are in fact risking the loss of that precious spectrum, why not make a communicator or an ASCII-only class of license for something like 1296 MHz? Seems to me that here would be a perfect location to try the idea out, and just how many present users would be put out? Just how many people are using 1296 or 10,000 MHz? What percentage of hams? Just maybe we would be aghast to find out how many hams have *ever* used 1296, much less a Gunn-diode transceiver.

As you know, modern 1.2-GHz equipment is now produced by at least one company (ICOM) that also produces an off-the-shelf repeater for 1.2 GHz. Computer clubs are rich and crazy enough to promote a great way to ship 1200-baud data without wires and without the monthly bill from the local phone company. Maybe this would be an angle to consider.

I'll bite on your comment. What does one have to do to petition this kind of an idea to the FCC, or would it be a waste of time because some self-styled organization would dropkick the idea out of the stadium as soon as they heard it?

John Lockwood
Orem UT

One merely writes one's proposal to the FCC, Washington DC 20554, preferably with innumerable (16) copies and the original notarized. And yes, the likelihood is that the organization you referred to will fight you tooth and nail.—Wayne.

NO VOICE

I am writing this note out of appreciation for your dedication to amateur radio. I have been instructing classes in my town for several years in both Novice- and General-class code and theory. Very few school-age children apply, and overall I have a very high dropout rate. No one else in town (we have 12 or 13 hams in a town of 6000) wants to teach a class, so if it gets done, I do it. Very few have dropped out because of the code. Only those who couldn't spell had trouble. Most left because the Novice license includes no voice privileges.

Traditionally, Novices had voice on 145-147 MHz. I believe that since the Novice ticket is a 10-year renewable license, some voice privileges should be included. Wouldn't it be swell if the FCC allowed 200 Watts PEP phone for Novices in the new 10-meter phone band at, say, 28.325 to 28.375 MHz? This would give incentive to aspiring Novices, create a new market for SSB equipment, and provide lots of use for converted CB sets. Since we'd like to attract the young computer set, perhaps we could also ask for Novice RTTY privileges using ASCII on 28.190 to 28.200 MHz. Then we could offer Novices with computer/modem experience a place to play.

What do you think, Wayne? I don't know how to go about petitioning the FCC. Can you help me? Are these good ideas? How about changing the CW test for amateurs to: Novice, 5 wpm; Technician, 10 wpm; General, 15 wpm; Advanced, 20 wpm; Extra, 25 wpm. Is this too hard on the amateur community? Then how about: Novice, 0 wpm; Technician, 5 wpm; General, 10 wpm; Advanced, 15 wpm; Extra, 20 wpm? There, we haven't hurt the Extras, the Advanced can cope with 15, the Generals get a break, Technicians get no change, and the Novices have to know code to operate anyway, so why test them? Just let them have at it.

Larry W. Garens KC5OQ
Brady TX

Fine, see my comments to Lockwood. —Wayne.

KEEP PUSHING

Keep up the good work! I enjoy your editorials immensely. It's very nice to read views which are both innovative and futuristic. Your dedication to amateur radio and the advancement of electronic technology is very evident and appreciated.

I have been teaching senior high school for sixteen years with varying success in inspiring students to study for their ham ticket. You hit the nail right on the head—kids today do suffer from the immediate gratification syndrome. The only goals they perceive as worthwhile are immediate. I have tried too many different approaches to detail, but I can't get past the immediate gratification problem. It's worse today than it was 10 years ago. At one time I had 14 licensed hams in school. Each year it has become fewer until now I have only one. I like your idea of trying a no-code license. I know 15 years ago I had a lot of trouble with the code, but I didn't suffer from immediate gratification syndrome and I made it.

It's too bad the league didn't pick up on no-code licensing before you started the push. It seems certain people can't stand the thought of Wayne Green being right again! Keep pushing, Wayne, for no-code licensing; you know you are right, I know you are right, and a lot of other people know you are right but won't admit it!

I have come to the conclusion that people who think like us are in the minority because technology has moved too fast for most to comprehend. A lot of hams, teachers, administrators, school boards, and parents are too naive to comprehend the type of education needed by their children to survive in our technological society of today. Someone once said that you never stop learning. What we have to do, Wayne, and others like us, is *never stop teaching!*

Phillip Wedige WB9PCI
Sun Prairie WI

HINT

I read with great interest "Perfboard and Soldertail?" in the July, 1984, edition of *73*, and also AF9Q's letter concerning additional techniques. One hint that I would like to share concerns the way AF9Q (and probably many others) cuts out the copy of the board layout. I have used a slightly different method for quite some time and have turned out some very nice boards.

After obtaining a good copy of the layout (thus preserving the original) and taping it to the board, I use a sharp, pointed tool such as an ice pick to carefully pierce through the paper and into the copper board. Not only does this system tell you exactly where to drill the hole, but the dent serves as a pilot hole for the bit. I know from experience what one slip of the drill can do to a board!

Robert Gooch, Jr. N3DRW
Baltimore MD

LISTEN

While I find your editorials interesting as well as informative, you have failed to put any effort into helping the new Novice. In your editorials you have harped on the subject of getting teens involved in amateur radio. That is all well and good, but any campaign to get teens involved will be

of no avail if you or others in the amateur community fail to realize that there are at least two major problems facing the new Novice.

First, the Novice subband at 40 meters is not totally useable due to broadcast stations like the BBC using a great portion of this band. Have you approached the FCC about this? Has the ARRL done anything? If so, I haven't seen it.

Second, it seems as though the amateur community is not generally willing to make a QSO with a Novice due to his mistake-ridden, slow-fisted style. Is it any wonder why more people, including teens, are not willing to put forth any effort to become a part of the amateur fraternity?

Another large problem that teens face is money. Look at the ads in your magazine. The equipment is not cheap by any stretch of the imagination. How can anyone be expected to become interested in ham radio under these conditions?

Will we lose the 220-MHz band? Unless something is done to encourage our Novices things will get worse. Then the question of a no-code license crops up. The excuse that code is too hard to learn or to cope with is a feeble one. Just look at the pre-teens who are "coping" with it. If a pre-teen can do it, why can't a few adults?

I am very surprised to see that no one seems to care about *these* problems instead of the dead no-code issue. I agree that we as amateur-radio operators do need to be concerned about losing spectrum, but shouldn't we be *more* concerned about bringing teens into amateur radio, and making it attractive enough for them to stay? If you are not aware of the problem of broadcast stations on the 40-meter Novice band, listen! If you are not aware of the lack of consideration given our Novices, listen!

Can you not see what is happening? Take a good look at our Novice subbands. Then write your editorial so that our Novices know that you, the FCC, and the ARRL care.

Bill Dethlefsen KA9RAP
Chicago IL

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

Well, I see by the old calendar on the wall that the Orwellian year, 1984, has passed us by, and Happy New Year to you all!

Gotta start out this month with a quick look back. In November, 1984, I detailed a scheme thought up by Jim Conner W3HCE for interfacing a Heathkit® HD-3030 RTTY terminal unit to the station. Well, Jim passes along that there are two errors in the main schematic, shown in Fig. 1 of the column: 1) pin 4 of S1C should go to pin 1 of the VHF transmitter plug—*not* to pin 2 of the VHF transmitter plug, and 2) pin 4 of S1G should go to pin 3 of S1E—*not* to pins 3 and 4 of S1D. Otherwise, according to Jim, all is correct as published. I will be interested to hear from those of you who put this interesting interface to use.

Continuing in the New Year/new broom department, back in September, 1984, I mentioned that Tom Zeltwanger KG3V has a RTTY program available, but I stated that it was for the wrong computer! Sorry about that, Tom. To set the record straight, Tom's program is for the Commodore 64, only. I am sure he would like to hear from you, at PO Box 62, State College PA 16804, if you are interested.

A question relating to a really old column has been received from Dayton Johnson W0ZI. Dayton was looking at the listing of Murray versus AMTOR codes published in November, 1983, and questions whether the Murray is not inverted. Well, Dayton, it all depends on how you look at it. For example, in my list I stated that the code for the letter A is 11000. With 1 representing mark and 0 representing space, this is the way the character is usually presented. Similarly, the ASCII letter A is 01000001. However, and this is the root of the confusion, the ASCII code is sent from the least significant bit to the most significant bit, that is, from right to left. The Murray, on the other hand, is sent from left to right, most significant to least significant.

The practical application of this is that the parity bit, if used, appears as the most significant bit, which is the last one sent. So, if you do not use a parity bit on ASCII, the stop bit or bits take its place. There is no parity bit in Murray, and the way the bits are presented goes way back to the days of punched tape. In that medium, the leading 1 of the Murray A would be at the upper edge of the tape, so, reading top down, 11000 would be the logical reading. Of course, ASCII punched tape looks the same way, but the characters are transmitted in the reverse order. Hope that clears things up.

Another little mistake, let's call it a typo. Back in August, 1984, I mentioned that a company called QEI, Inc., had acquired much of the old stock from the Northern Radio Company, manufacturers of some of the older RTTY gear. Unfortunately, a printer's gremlin scrambled their address. Write QEI at 60 Fadam Road, Springfield NJ 07081, if you like. Thanks and tip of the keyboard to Jeffrey Gornstein KD2BE for the correction.

Here's an item of interest for Spanish-speaking amateurs. The magazine *RTTY Journal* is now being published in Spanish, with Juan Rydzik LU4EGE as editor. If you are interested, drop them a note at *RTTY Journal* (Spanish edition), PO Box 64, 1706-Haedo, Buenos Aires, Argentina. Be sure to tell them you read about them in *73*'s "RTTY Loop." OK?

Until recently, when I used the term "mailbox" in this column, it referred to the place that I pick up the letters that you readers send me. But these days, mailbox has taken on an exciting new meaning. After the fashion of the telephone access BBSs, or bulletin board systems, put online by the computer crowd, these radio mailboxes, or MSOs, represent a new facet of RTTY.

CALLSIGN	FREQUENCY	SYSTEM	ACCESS	CITY	STATE
AJOX	14.087.7	HAL	?????	LAUREL	MS
KOKXR	3.626.0	????	KXRZW	VERMILLION	SD
KOVKH	14.087.7	HAL	MSOVKH	RAPID CITY	SD
K1VYQ	14.097.5	RATT	:K1VYQ	RIDGEFIELD	CT
KB1S	14.087.7	HAL	MSOKB1S	WESTWOOD	MA
W1PW	14.097.5	CROWN	PWZW	MORGAN HILL	CA
N1BLB	14.097.5	CROWN	BLBZW	BLUE BELL	PA
W1CDM	14.097.5	MACRO	CDMZW	LEMON GROVE	CA
W1UKZ	14.085.0	RATT	:W1UKZ	SCITUATE	MA
WA1IUF	14.097.5	MACRO	1UFZW	NEW HAVEN	CT
WB2IIF	14.080.0	MACRO	IIFZW	SPRINGLAKE HTS	NJ
AD4V	14.087.7	CUSTOM	MSOD4V	KNOXVILLE	TN
K4CJ	70.322.5	????	K4CJZW	LAKEMONT	GA
K4CZ	7.098.5	HAL	CZZW	LEXINGTON	KY
K4ILC	14.077.1	HAL	K4ILCZW	MIAMI	FL
K4KOZ	14.087.7	HAL	MSOKOZ	BOCA RATON	FL
K4PA	14.077.1	????	????	RESTON	VA
K4ZBG	14.077.1	MACRO	ZBGZW	FRESNO	CA
KA4V	14.077.1	MACRO	KA4VZW	FRANKLIN	NC
KE4TV	7.085.0	RATT	:KE4TV	SAVANNAH	GA
W4XN	14.077.1	????	????	ALEXANDRIA	VA
WB4ZOB	7.087.7	HAL	MSOZOB	ROBBINSVILLE	NC
WD4MTC	14.087.7	HAL	MSOMTC	FORT MEYERS	FL
WD4SGU	14.087.7	CUSTOM	MSOSGU	FORT MEYERS	FL
K5FL	14.087.7	????	MSO5FL	DENTON	TX
W5QXK	14.087.7	HAL	MSOQXK	RICHARDSON	TX
W5VXF	14.097.5	HAL	MSOVXF	HOUSTON	TX
WB5MXS	14.080.0	RATT	:WB5MXS	MATAIRIE	LA
WB5NYA	14.087.0	HAL	MSONYA	MIDWEST CITY	OK
WD5BJQ	14.080.0	RATT	:WD5BJQ	MATAIRIE	LA
KA6CDC	14.097.5	RATT	:KA6CDC	HENDERSON	KY
KH6OD	14.097.5	RATT	:KH6OD	JACKSON	MS
W6ZRR	14.087.0	HAL	MSOZRR	SAN LUIS OBISPO	CA
K7IFG	14.087.7	CUSTOM	MSOIFG	PORTLAND	OR
KV7G	14.087.7	CUSTOM	????	GLENROCK	WY
WB7QWG	14.097.5	CUSTOM	QWGZW	INDIANAPOLIS	IN
K8EWK	14.087.0	HAL	MSOEWK	COLUMBUS	OH
K8IF	10.145.0	RATT	:K8IF	BRIGHTON	MI
K8ZGZ	7.085.5	HAL	MSOZGZ	MANSFIELD	OH
KA8KYR	3.627.0	HAL	????	MANISTIQUE	MI
WB8ICL	14.087.7	HAL	MSOICL	YELLOW SPRINGS	OH
WB8ZTV	3.635.0	HAL	MSOZTV	MOUNDSVILLE	WV
WD8CEB	7.091.0	CUSTOM	.CEBZ	FREMONT	OH
WD8LZZ	14.100.0	CUSTOM	MSOLZZ	MANSFIELD	OH
K9KUW	14.087.7	HAL	MSOKUW	KENNEY	IL
W9CD	14.087.7	HAL	MSO9CD	OLYMPIA FALLS	IL
W9JBM	14.087.7	HAL	MSOJBM	HOMEWOOD	IL
		Foreign Stations			
VE3KPK	3.635.0	MACRO	????	ONTARIO	CANADA
VK2HL	14.097.5	MACRO	HLZW	DEE WHY	AUSTRALIA
VK2XY	14.097.5	MACRO	2XYZW	SYDNEY	AUSTRALIA
YV5CIV	7.040.0	MACRO	CIVZW	CARACAS	VENEZUELA
ZF1GC	14.097.5	MACRO	XFGC1ZW	GND CAYMAN	CAYMAN IS

Fig. 1. Mailbox listing.

Several months ago I mentioned one such MSO, run by Bob Kling K8GJL of Vandalia, Ohio. Bob states that he is running his over the local 146.25/146.85 repeater, with the cooperation of the repeater control station. For hardware, he is using a VIC-20 computer with a 16K expander. The MSO program is written in Basic and has storage for about 8K worth of messages. He has found this to be adequate for a local two-meter system, supporting about a dozen stations on RTTY. He is using an old tube-type terminal unit, made by Alltronics-Howard, and is keying the VIC-20 through an optoisolator. This proves what I have been preaching for some time—you don't need one of the fancy new demodulators to get on RTTY, especially not VHF RTTY where the "clear channel signal" abounds! Running a massive 500 mW with an old HR2B transceiver, the MSO has been on twenty-four hours a day without problems.

Another system up and running has been the one out in Santa Fe, New Mexico. The Santa Fe Amateur Radio Club has a repeater on 147.81/147.21 that is a backup for their main repeater on 146.22/146.82.

The 81/21 machine has been mostly quiet except for the RTTY tones of Alan Hill N5BGC and the bunch. As of the time he dropped me a note, he was still investigating programs to put on, using a VIC-20 as a control computer. Amateurs in the area might zip up to frequency and check it out.

Another group reaching out over the air is up in Manitoba, Canada. J. Gary Mills VE4CM in Winnipeg writes that a number of the hams in his area are experimenting with 1200-bps ASCII RTTY on two meters. The computer in use at VE4CM is a 6809 machine running Flex; others on the air include TRS-80s with modified ASCII terminal programs. It sounds like a lot of fun and may well develop into a high-tech RTTY network.

Now, here is the biggest list to date! Kris Torrey KA6VQI in Colton, California, sends along a list prepared for the Commodore Communicator. This BBS is no longer on line, Kris writes, because of poor software and board crashes. Anyway, he supplies the list shown in Fig. 1 which includes mailboxes across the United States, and a few foreign countries as well. I don't know how many of these MSOs are still up; this list was first compiled in October, 1983, but it is the most complete listing I have seen to date.

If you are running an MSO or working through one in your area, why not send the details along to me at the above address. I will keep some kind of record and try to publish an up-to-date list periodically.

Speaking of software, I receive a good number of letters each month asking for program suggestions for this or that computer. In the past, I have tried to answer them from whatever material is at hand from recent communications. I would like to try another way. This month, would each and every one of you who is using a TI-99/4 computer drop me a short note and let me know what kind of software you are using and what you think of it? It does not have to be a long letter, a postcard or QSL is fine. In coming months I will ask for other computers, giving some way to compile a sense of what is in use among RTTYers. If responses come in as expected, I should be able to report some information about three or four months after you see the question presented here. Thanks for your cooperation.

Thanks also for the interesting comments and questions to Russell F. Streeper WA4BWB, Lynchburg, Virginia, F. C. Horn WA4JPP, Jekyll Island, Georgia, Allen Kempke, Hancock, Michigan, and Gilbert Marazzini, Milan, Italy. I do appreciate hearing from you and I try to answer your questions as soon as possible. And for those of you who have asked, yes, there are still reprints of several back columns available. Drop me a line at the above address and enclose a self-addressed, *stamped* envelope for a listing of what is available. In the next "RTTY Loop," more responses to the information that you all tell me is the first that you read when your subscription issue of *73* arrives. Not a subscriber yet? Shame on you—you might miss the next "RTTY Loop!"

SATELLITES

USING THE AO-10 APOGEE PREDICTIONS

Apogee predictions for the month of January are provided for three sections of the United States: Washington DC at 39N 77W, Kansas at 39N 95W, and California at 38N 122W. Times are in UTC and apogee in this case is mean anomaly 128 rounded to the nearest whole hour. Use the chart as a guide in aiming your antenna, then fine-tune the azimuth and elevation values to peak the satellite's beacon signal. If you require more accurate orbital predictions, contact AMSAT at PO Box 27, Washington DC 20044.

AMSAT-OSCAR 10 APOGEE PREDICTIONS
JANUARY 1985

			WASH		KANSAS		CALIF	
ORBIT	DAY	TIME	AZ	EL	AZ	EL	AZ	EL
1168	1	0300					258	20
1169	1	1400	86	3				
1170	2	0200			268	8	250	30
1172	3	0100	274	4	262	18	241	40
1174	4	0000	267	13	255	28	228	49
1176	5	0000	262	16	248	30	218	49
1178	5	2300	254	26	238	39	200	56
1180	6	2200	246	35	226	48	176	58
1182	7	2200	238	37	216	48	167	55
1184	8	2100	226	46	197	54	146	52
1186	9	2000	210	53	175	57	128	46
1188	10	1900	189	58	152	55	115	38
1190	11	1900	178	55	146	50	113	32
1192	12	1800	156	54	129	44	103	24
1194	13	1700	137	49	116	37	94	15
1196	14	1700	132	44	113	31	93	9
1198	15	1600	119	36	103	22	85	1
1200	16	1500	107	28	95	14		
1201	17	0300					272	4
1202	17	1500	106	22	94	8		
1203	18	0200					266	14
1204	18	1400	97	14	85	0		
1205	19	0200					260	16
1206	19	1400	96	8				
1207	20	0100			271	4	253	26
1208	20	1300	88	0				
1209	21	0000	276	0	264	14	244	36
1213	22	2300	264	12	251	26	224	46
1215	23	2200	257	22	242	36	207	53
1217	24	2200	250	24	234	37	196	52
1219	25	2100	242	33	221	46	175	54
1221	26	2000	231	43	204	52	153	53
1223	27	2000	222	43	194	51	147	48
1225	28	1900	206	50	173	53	130	42
1227	29	1800	186	54	153	51	117	35
1229	30	1700	164	54	135	46	107	26
1231	31	1700	156	50	131	40	105	20

HAM HELP

I need a schematic for an Eico model 751 power supply. Also, how can I improve the frequency stability of an Eico model 753 triband transceiver? I will pay for postage and copying.

Patrick Benesch KB4EGJ
General Delivery
Loyall KY 40854

I would like to borrow the schematics and/or instruction manuals for the following Heathkit equipment: DX-35 transmitter, AR-3 receiver, and HD-20 XTAL calibrator. I will pay postage both ways.

Greg Magarie WA1VIL
33 Barnesdale Rd.
Natick MA 01760

I have inherited an FM VHF marine transceiver, the Aerotron Sealine, manufactured by Aeronautical Electronics, Inc., of Raleigh, North Carolina. They have moved and I was wondering if someone could help me locate them. I also am in need of its schematic and operator's manual. The info on it is FCC type 6W35/SLT-8, serial number 684756. I will gladly pay any cost incurred.

Frank B. Payne KD6DL
2712 Los Amigos Dr.
Rancho Cordova CA 95670

Can anybody supply a copy of the Eico 324 signal generator operations manual?

H. L. Church W0KXP
PO Box 126
Lebanon IL 62254-0126

I need a schematic and power transformer for an Ameco model PCL-P preamp.

T.H. Jenson KE6WE
910 Kelton St.
Tehachapi CA 93561

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

from page 4

this work. With six DXpeditions per year, that would call for around 70 hams interested in investing $3,000 each for the trip of a lifetime. I know I'd get oversubscribed if I asked for Japanese volunteers, but do we have even half that many American hams interested in going on DXpeditions?

Where to? Rare spots—perhaps Iraq, China, Macao, Sarawak, Brunei, Sabah, Lesotho, Swaziland, Fiji, New Caledonia, Western Samoa—there are lots of rare spots which are exciting to visit. I've been in all of the above and operated from most of 'em, so I know they're fascinating places for visiting and for DXing.

You know, if I could get letters from at least 50 readers willing to sign up for one week of excitement—the memories of a lifetime—I'd start setting up some trips, getting the portable ham gear and the video equipment we'd need to turn out some broadcast-quality tapes. Some of the going can be rough, so no weak hearts or backs, okay?

How'd you like to get away for a week to some out-of-the-way corner of the world, yet be able to travel on jets and stay at first-class hotels? You'd be on the hot end of the pileups, keeping your log on a picocomputer which would automatically check for duplicate contacts, print the log, and even print QSL cards later on! It would also let you know how many contacts you've made with how many countries, how many prefixes, zones, and so on.

No, we won't be going to places where we'll get shot at, like Spratly.

Are you game?

AWARDS

Bill Gosney KE7C
Micro-80, Inc.
2665 North Busby Road
Oak Harbor WA 98277

THE AWARDS PROGRAM OF *73: AMATEUR RADIO'S TECHNICAL JOURNAL*

It's been six years since the initial announcement of the *73* Awards Program. Since its introduction in 1979, we've seen the program grow to become one of the most popular challenges facing amateurs today.

Consisting of six domestic and five DX operating achievements, the program has captured the interest of rag-chewers, DXers, and contesters alike.

The requirements are not as easy as one might first imagine. Once you qualify for a *73* award, you know you've earned it. Last month we featured the six domestic awards. Now, here are the five DX awards:

WORK THE WORLD DX AWARD

To enhance the enjoyment of working DX, the editors of *73* take special pleasure in introducing the most complex and probably one of the most sought-after DX awards available today—the Work the World DX Award.

1. The WTW Award is available to licensed amateurs and SWL stations worldwide.

2. To be valid, all contacts must be made on or after January 1, 1979. There are no band or mode restrictions. Special single-band or -mode achievements may be recognized if you make your request at the same time application is made.

3. The Work the World program consists of six individual continental awards (North American, South American, European, Oceanic, Asian, and African), each of which is a worthy single accomplishment of its own. To be eligible for the 7th and ultimate award (the WTW Award), applicants first earn the continental recognition. Once all six awards have been applied for, the WTW award will be issued to the applicant at no charge. The operator who earns WTW recognition has truly "worked the world."

4. Requirements for the individual continental awards: North American Award—a minimum of 13 North American countries; South American Award—12 South American countries minimum; European Award—a minimum of 12 European countries; African Award—12 African countries minimum; Asian Award—12 Asian countries minimum; Oceanic Award—a minimum of 12 Oceanic countries.

5. To apply, prepare a list of claimed contacts for each continent. List contacts in prefix order. Include the date and time in GMT and the band and mode of operation.

6. If you are submitting your sixth (6th) continental award, please alert the Awards Manager to this fact.

7. *Do not send QSL cards!* Have your

AWARD RECIPIENTS
(as of 9-1-84)
WORK THE WORLD AWARD

177.	FM7WD	194.	WB3BVL
178.	ZS6FL	195.	4Z4VG
179.	WB6TJW	196.	VE7DRI
180.	VE6CNV	197.	K2NT
181.	N2CBU	198.	I2YJO
182.	I8QLI	199.	I2KKL
183.	OZ-DR1239	200.	WDØAVG
184.	OE3HPA	201.	JR3AKG
185.	HK5CKH	202.	N7AHQ
186.	KD7ET	203.	ISØKNG
187.	IK1AOD	204.	YBØZM
188.	W5RKK	205.	OZ1ACB
189.	WB5YPE	206.	DA1WJ
190.	WB2DHY	207.	JA1KRU
191.	KS1L	208.	YBØBZZ
192.	W6BCO	209.	JA9GXY
193.	P29NSF		

AWARD RECIPIENTS
(as of 9-1-84)
AFRICAN AWARD

235.	FM7WD	264.	OZ5EDR
236.	ZS6FL	265.	I2YJO
237.	VE3-9094	266.	I2KKL
238.	JR7ICN	267.	KA2PHQ
239.	N4GQO	268.	JF2MVI
240.	KB2VO	269.	ZS6BWW
241.	LA4VL	270.	ZS6BWP
242.	OZ1ACB	271.	WDØAVG
243.	WB6TJW	272.	JR3AKG
244.	JY9CW	273.	JA3CJL
245.	N2CBU	274.	IT9GFE
246.	I8QLI	275.	ISØKNG
247.	IK1AOD	276.	YBØZM
248.	W5RKK	277.	KA1CLV
249.	WB5YPE	278.	N7AHQ
250.	DA1WJ	279.	JA2-8964
251.	OE3HPA	280.	YCØEBS
252.	HK5CKH	281.	JH1DLJ
253.	KD7ET	282.	JJ1EEA
254.	5B4MF	283.	CT1AUO
255.	WB2DHY	284.	JH1KKT
256.	KS1L	285.	JA1KRU
257.	W6BCQ	286.	JH3CBN
258.	K2NT	287.	SM6DUA
259.	YBØBZZ	288.	JA9GXY
260.	VE7DRI	289.	JR6DQC
261.	OE3HCS	290.	JA8RII
262.	YS9HH	291.	PY2CXH
263.	PY2DBU		

AWARD RECIPIENTS
(as of 9-1-84)
EUROPEAN AWARD

350.	FM7WD	385.	KA2PHQ
351.	ZS6FL	386.	PY2FDO
352.	VE3-9094	387.	JF2MVI
353.	N4GQO	388.	KY6I
354.	VQ9JW	389.	YCØEBS
355.	LA4VL	390.	CT1AUO
356.	WB6TJW	391.	JR3AKG
357.	WA9AEA	392.	HC2DQ
358.	WL7F	393.	YC5RJ
359.	N2CBU	394.	JA3CJL
360.	ZS6BWW	395.	ISØKNG
361.	I8QLI	396.	YBØZM
362.	IK1AOD	397.	JP1FEE
363.	YBØBZZ	398.	JH7XRB
364.	W5RKK	399.	JR3KAH
365.	WB5YPE	400.	JH1FTS
366.	DA1WJ	401.	OZ7HVI
367.	OE3HPA	402.	JF2AFJ
368.	PY2TRD	403.	JE2GJD
369.	PY2DBU	404.	JR1RMY
370.	KD7ET	405.	JA2-8964
371.	N7EQT	406.	JA1KRU
372.	5B4MF	407.	JH3CBN
373.	WB2DHY	408.	SM6DUA
374.	YS9HH	409.	JA9GXY
375.	KS1L	410.	JF1VXB
376.	W6BCQ	411.	JR6DQC
377.	P29NSF	412.	JR1DTN
378.	YB5NA	413.	JA8RII
379.	K2NT	414.	HL1ACW
380.	OE3HCS	415.	JG1HXC
381.	YC5QZ	416.	PY2CXH
382.	Hoiss—SWL	417.	DU7EV
383.	I2YJO	418.	JR7EQL
384.	I2KKL		

AWARD RECIPIENTS
(as of 9-1-84)
SOUTH AMERICAN AWARD

269.	KB2VO	295.	W6BCQ
270.	OZ-DR1239	296.	P29NSF
271.	PY2SZK	297.	5B4MF
272.	N4GQO	298.	K7DBV
273.	JR7ICN	299.	VE7DRI
274.	VE3-9094	300.	K2NT
275.	ZS6FL	301.	I2YJO
276.	FM7WD	302.	I2KKL
277.	WP4ATF	303.	KA2PHQ
278.	WB6TJW	304.	KA5BQM
279.	WA9AEA	305.	WB2VTD
280.	N2CBU	306.	CT1AUO
281.	OZ5EDR	307.	JR3AKG
282.	I8QLI	308.	HC2DQ
283.	DA1WJ	309.	OZ1ACB
284.	OE3HPA	310.	YBØBZZ
285.	KY6I	311.	YBØZM
286.	PY2DBU	312.	ISØKNG
287.	KD7ET	313.	JA1KRU
288.	IK1AOD	314.	K2YOF
289.	N2EGR	315.	JH3CBN
290.	W5RKK	316.	JA9GXY
291.	WB5YPE	317.	PY2CXH
292.	WB2DHY	318.	PY1DEA
293.	YS9HH	319.	XE1JIW
294.	KS1L		

AWARD RECIPIENTS
(as of 9-1-84)
ASIAN AWARD

207.	LA4VL	232.	4Z4VG
208.	VQ9JW	233.	OE3HCS
209.	VE6CNV	234.	VE7DRI
210.	VE3-9094	235.	K2NT
211.	ZS6FL	236.	I2YJO
212.	FM7WD	237.	I2KKL
213.	WB6TJW	238.	KA2PHQ
214.	N2CBU	239.	JF2MVI
215.	JY9CW	240.	VE7EDA
216.	I8QLI	241.	JR3AKG
217.	IK1AOD	242.	JA3CJL
218.	YBØBZZ	243.	ISØKNG
219.	W5RKK	244.	YBØZM
220.	WB5YPE	245.	JA2-8964
221.	DA1WJ	246.	JR1RMY
222.	OE3HPA	247.	OZ7HVI
223.	HK5CKH	248.	YCØEBS
224.	N7AHQ	249.	JA1KRU
225.	JR6GSE	250.	JH3CBN
226.	KD7ET	251.	SM6DUA
227.	WB2DHY	252.	JA9GXY
228.	KS1L	253.	WA1UDH
229.	W6BCQ	254.	PY2CXH
230.	P29NSF	255.	PY2DBU
231.	5B4MF		

list of contacts verified by two amateurs or a notary public.

8. The fee for each continental award is $5.00 in US funds only. We are sorry, but we can no longer accept IRCs or foreign currency. Checks written on foreign banks must be payable in US funds.

9. Forward your application(s) and fee(s) to: Bill Gosney KE7C, *73* Awards Manager, 2665 N. Busby Road, Oak Harbor WA 98277, USA.

73 DX COUNTRY CLUB AWARD

1. Available to licensed amateurs and SWL stations worldwide.

2. To be valid, all claimed contacts must be made in a single calendar year (January 1 through December 31), beginning January 1, 1979.

3. This award is issued for phone, CW, and mixed modes. Should the applicant wish to recognize a single-band or mixed-band accomplishment, the preference must be stated when making the application.

4. A minimum of seventy-three (73) DX countries must be worked and confirmed from the *73* WTW (Work the World) DX listing.

5. Annual endorsement stickers are available for each succeeding year in which application is made and a minimum of 73 DX countries are worked.

6. To apply, prepare a list of claimed contacts in prefix order. Include each station's callsign, date and time of contact in GMT, mode, and band of operation.

7. *Do not send QSL cards.* Have your list of contacts verified by two amateurs or a notary public.

8. Award fee is now $5.00. Endorsements are granted for a fee of $2.50. Do not send IRCs or foreign currency; they can no longer be accepted. Checks on foreign banks must be payable in US funds.

9. Forward your application and fee to: Bill Gosney KE7C, *73* Awards Manager, 2665 N. Busby Road, Oak Harbor WA 98277, USA.

AWARD RECIPIENTS
(as of 9-1-84)
NORTH AMERICAN AWARD

296.	FM7WD	317.	W6BCQ
297.	ZS6FL	318.	P29NSF
298.	VE3-9Ø94	319.	K2NT
299.	JR7ICN	320.	OE3HCS
300.	N4GQO	321.	VE5ADO
301.	KB2VO	322.	YS9HH
302.	WB6TJW	323.	I2YJO
303.	WA9AEA	324.	I2KKL
304.	N2CBU	325.	KA2PHQ
305.	PY2DBU	326.	CT1AUO
306.	I8QLI	327.	JR3AKG
307.	DA1WJ	328.	IT9GFE
308.	OE3HPA	329.	ISØKNG
309.	KY6I	330.	YBØZM
310.	KD7ET	331.	JA1KRU
311.	IK1AOD	332.	YBØBZZ
312.	N2EGR	333.	SM6DUA
313.	W5RKK	334.	JA9GXY
314.	WB5YPE	335.	VE7EDA
315.	WB2DHY	336.	XE1JIW
316.	KS1L	337.	HC2DQ

AWARD RECIPIENTS
(as of 9-1-84)
OCEANIC AWARD

223.	KA2JJK	250.	JF2MVI
224.	K7DBV	251.	PY2DBU
225.	ZS6LF	252.	DA1WJ
226.	FM7WD	253.	WDØAVG
227.	WB6TJW	254.	JR3AKG
228.	KA6HTC	255.	JA3CJL
229.	N2CBU	256.	ISØKNG
230.	I8QLI	257.	YBØZM
231.	IK1AOD	258.	WA1UDH
232.	YBØBZZ	259.	OZ1ACB
233.	W5RKK	260.	JA2-8964
234.	WB5YPE	261.	JH3CBN
235.	OE3HPA	262.	KA1KRU
236.	KD7ET	263.	KC9XL
237.	VE7EDA	264.	JF2AFJ
238.	WB2DHY	265.	JE2GJD
239.	KS1L	266.	JR1RMY
240.	W6BCQ	267.	W2-6893
241.	P29NSF	268.	JA9GXY
242.	WB3BVL	269.	WØIKD
243.	JK1PTQ	270.	K7PRH
244.	YS9HH	271.	I8HZT
245.	4Z4VG	272.	HL1ACW
246.	VE7DRI	273.	KH6JOI
247.	K2NT	274.	XE1JIW
248.	I2YJO	275.	I8JKN
249.	I2KKL		

AWARD RECIPIENTS
(as of 9-1-84)
SPECIALTY COMMUNICATIONS AWARD (Class A-1)

29. 5Z4DA(RTTY)
30. W9HR(OSCAR)
31. IK1AOD(RTTY)
32. I1BRB(OSCAR)
33. YCØEBS(RTTY)
34. YBØZM(RTTY)

SPECIALTY COMMUNICATIONS ACHIEVEMENT AWARD (CLASS A-1)

1. This award has become very popular, especially with the advent of the new OSCAR satellite and the widespread use of personal computers for RTTY. It is made available to licensed amateurs and SWL stations throughout the world.

2. To be eligible, all contacts must be made on or after January 1, 1979. Only communications via SSTV, RTTY, EME (Earth-moon-Earth), and/or OSCAR will be recognized for award credit. Contacts between stations on OSCAR and EME may be made using the mode authorized in your country. Mixed-mode contacts are not valid, however.

3. To qualify, applicants must work a minimum of ten (10) DX countries from the WTW DX Countries listing. Special recognition will be made for those exceeding the ten-country minimum.

4. To apply, the applicant must prepare a list of claimed contacts in callsign prefix order. Include the date and time in GMT, the band and mode of operation, and a description of your equipment and antenna system used to make the contacts.

5. *Do not send QSL cards.* Have your list of contacts verified by two amateurs or a notary public.

6. The award fee is now $5.00 in US funds only. IRCs or foreign currency is not acceptable. Foreign checks must be payable in US funds.

7. Forward your application and award fee to: Bill Gosney KE7C, *73* Awards Manager, 2665 N. Busby Road, Oak Harbor WA 98277, USA.

DX CAPITALS OF THE WORLD

1. This award is made available to licensed amateurs and SWL stations throughout the world.

2. All claimed contacts must be made on or after January 1, 1979. There are no band or mode restrictions. Special recognition will be given for single band or mode if requested at the time application is made.

AWARD RECIPIENTS
(as of 9-1-84)
DX CAPITALS OF THE WORLD AWARD

31.	W2-6893	36.	FM7WD
32.	I8HZT	37.	YBØZM
33.	JA1VDJ	38.	WA8KMK
34.	SV1MO	39.	JH3CBN
35.	KI2G	40.	JJ1EEA

AWARD RECIPIENTS
(as of 9-1-84)
TEN METER DX DECADE AWARD

12.	KA3FUU	16.	DA2ZF
13.	W2-6893	17.	I7ZQE
14.	KD5VR	18.	WB3LTT
15.	DA1WJ		

3. To qualify, applicants must work and confirm a minimum of fifty (50) different national capital cities in the world. Only capital cities of those countries appearing on the WTW DX listing qualify. Should a country be contacted whose capital city is not commonly known, go ahead and list it in your application. The awards editor reserves the right to make a final determination.

4. To apply, make a list of contacts made in prefix order. Indicate the station callsign, date and time in GMT, band and mode of operation, the name of the national capital city, and the DX country.

5. *Do not send QSL cards.* Have your list of contacts verified by two amateurs or a notary public.

AWARD RECIPIENTS
(as of 9-1-84)
THE ANNUAL 73 DX COUNTRY CLUB AWARD

SSB

134. WA1SMI(82)
135. W3BHM(81)
136. K4JDJ(83)
137. VP2MO(81)
138. YBØBZZ(83)
139. W5RKK(83)
140. WB5YPE(83)
141. YBØZM(81)
142. OE3HCS(83)
143. WA1SMI(83)
144. KE7C(81)
145. KE7C(82)
146. KE7C(83)
147. KA2PHQ(83)
148. DJ7MD(83)
149. 4Z4PS(83)
150. KZ9A(83)
151. IT9GFE(83)
152. OZ1ACB(83)
153. IK6BOB(83)
154. IKØAZG(83)
155. ISØKNG(83)
156. PY2WE(81)
157. OE3WQB(83)
158. DJ7MD(84)

CW

22. OZ5EDR(82)
23. PT2ACZ(82)
24. KK4Y(82)
25. PY2FK(82)
26. VQ9JW(83)

Mixed Mode

25. KAØMMD(82)
26. W2GVX(82)
27. W9CC(82)
28. JH7VHZ(82)
29. LA4VL(82)
30. FM7WD(83)
31. DL5LAG(83)
32. KS1L(83)

6. Award fee is $5.00 and must be payable in US funds. We are sorry, IRCs or foreign currency can no longer be accepted.

7. Forward your application and award fee to: Bill Gosney KE7C, *73* Awards Manager, 2665 N. Busby Road, Oak Harbor WA 98277, USA.

TEN-METER DX-DECADE AWARD

1. The 10-Meter DX Decade Award is made available to licensed amateurs and SWL stations worldwide.

2. All contacts must be made on the 10-meter band using only low-power

✓ See List of Advertisers on page 80

WTW DX LISTING

NORTH AMERICA

C6	Bahamas
CO	Cuba
FO	Guadeloupe
FO, FS	Saint Martin
FM	Martinique
FO	Clipperton Is.
FP	St. Pierre & Miquelon
HH	Haiti
HI	Dominican Republic
J3, VP2G	Grenada & Dependencies
KC4, KP1	Havessa Is.
KG4	Guantenamo Bay
KL7	Alaska
KP4	Desechee
KP4	Puerto Rico
KS4, KP3, HK0	Serrana Bank and Roncador Cay
KV, KP2	Virgin Islands
OX, XP	Greenland
PJ6, 8	Saba Is.
VE	Canada
VE1	Sable Is.
VE1	St. Paul Is.
VO	Newfoundland, Labrador
VP2A	Antigua, Barbuda
VP2D	Dominica
VP2E	Anguilla
VP2K	St. Kitts
VP2L	St. Lucia
VP2M	Montserrat
VP2S	St. Vincent & Dependencies
VP2V	British Virgin Islands
VP5	Turks and Caicos Islands
VP9	Bermuda
W, K, N, A	United States of America
XE	Mexico
XF4	Rovillagigedo Islands
ZF	Grand Cayman Islands
6Y	Jamaica
4U	HQ, United Nations
8P	Barbados

SOUTH AMERICA

CE	Chile
CE9A	Easter Is.
CE0X	San Felix
CE0Z	Juan Fernandez
CP	Bolivia
CX	Uruguay
FY	French Guiana
HC	Ecuador
HC8	Galapagos Is
HK	Colombia
HK9	Bajo Nuevo
HK0	Malpelo Is.
HK0	San Andres & Providencia
HP	Panama
HR	Honduras
HR6	Swan Is.
KZ	Canal Zone
LU	Argentine
OA	Peru
PJ	Sonaire
PJ	Netherlands Antilles
PY	Brazil
PY6	Fernando de Noronha
PY8	St. Peter & St. Paul
PY8	Trinidade & Martim Vaz Is.
PZ	Surinam
TG	Guatemala
TI	Costa Rica
TI9	Cocos Is.
VP1	Belize
VP8	Falkland Is.
VP8, LU	South Georgia Is.
VP8, LU	South Orkney Is.
VP8, LU	South Sandwich Is.
VP8, LU	South Shetland Is.
VP8W	South Grahamland
YN	Nicaragua
YS	Salvador
YV	Venezuela
YVa	Aves Is.
ZP	Paraguay
8R	Guyana
9Y	Trinidad and Tobago

EUROPE

C3	Andorra
CT	Portugal
CT2	Azores
DA-DL	Federal Republic of Germany
DM, DT	German Democratic Republic
EA	Spain
EA6	Balearic Islands
EI	Republic of Ireland
EJ9	Aran Is.
F	France
FC	Corsica
G	England
GD	Isle of Man
GI	Northern Ireland
GJ, GC	Jersey
GM	Scotland
GM	Orkney Islands
GM	Shetland Islands
GU, GC	Guernsey
GW	Wales
HA	Hungary
HB	Switzerland
HB0	Liechtenstein
HV	Vatican
I	Italy
IC	Ischia
IA	Tuscan Archipelago
IS	Sardinia
IT	Sicily
JW	Bear Is.
JW	Svalbard Is.
JX	Jan Mayen
LA	Norway
LX	Luxembourg
LZ	Bulgaria
M1	San Marino
OE	Austria
OH	Finland
OH0	Aland Is.
OJ0	Market Reef
OK	Czechoslovakia
ON	Belgium
OY	Faeroe Islands
OZ	Denmark
PA	Netherlands
SM	Sweden
SP	Poland
SV	Greece
SV	Crete
SV	Dodecanese
SV	Mount Athos
TF	Iceland
UA, UK1, 3, 4, 6	European RSFSR
UA1, UK1	Franz Josef Land
UA2, UK2F	Kaliningradsk
US, UK, UT, UY5	Ukraine
UC2, UK2	White RSFSR
UO5, UK5O	Moldavia
UP2, UK2B, P	Lithuania
UQ2, UK2G, Q	Latvia
UR2, UK2R, T	Estonia
YO	Romania
YU	Yugoslavia
ZA	Albania
ZB	Gibraltar
3A	Monaco
4U	ITU, Geneva
9A	(See M1)

ASIA

A4X	Oman Is.
A5	Bhutan
A6X	United Arab Emirates
A7X	Qatar
A9X	Bahrain
AP	Pakistan
BV	Taiwan
BY	China
CR9	Macao
EP	Iran
HL, HM	North Korea
HL, HM	South Korea
HS	Thailand
HZ, 7Z	Saudi Arabia
JA-JR	Japan
JR6, KA6	Okinawa (Ryukyu Is.)
JD, KA1	Ogasawara
JT	Mongolia
JY	Jordan
KA	US Military in Japan
OD	Lebanon
S2	Bangladesh
TA	Turkey
UA, UK, UV	Asiatic RSFSR
UW9-0	Asiatic RSFSR
UD6, UK6C, D, K	Azerbaidzhan
UF6, UK6F, O, O, V	Georgia
UG6, UK6G	Armenia
UH8, UK8H	Turkoman
UI8, UK8I	Uzbek
UJ8, UK8J, R	Tadzhik
UL7, UK7	Kazakh
UM8, UK8M, N	Kirghiz
VS6	Hong Kong
VS9K	Kamaran Is.
VU	India
VU7	Andaman & Nicobar
VU7	Laccadives
XU	Khmer Republic
XV	Vietnam
XW	Laos People's Dem. Rep.
XZ	Burma
YA	Afghanistan
YI	Iraq
YK	Syria
1S	Spratly
4S	Sri Lanka
4W	Yemen
4X, 4Z	Israel
5B4, ZC	Cyprus
7O	People's Dem. Rep. of Yemen
8Z4	Neutral Zone Saudi Arabia/Iraq
9H	Malta
9H4	Gozo & Comino
9K	Kuwait
9M2	West Malaysia
9M6	North Borneo
9M8	Sarawak
9N	Nepal
9V	Singapore
	Abu Ail, Jabel Attair

OCEANIA

A3	Tonga Republic
CR8	Portuguese Timor
C2	Republic of Nauru
DU	Philippines
FK	New Caledonia
FO	French Polynesia
FW	Wallis & Fortune Islands
H4, VR4	Solomon Islands
JD, KA1	Minami Torishime
JD, 7J1	Okino Torishima
KB, KH1	Baker, Howland, American Phoenix
KC6	Eastern Carolines
KC6	Western Carolines
KG6, KH2	Guam Island
KG6R	Rota
KG6S	Saipan
KG6T	Tinian
KH6	Hawaiian Islands
KH7	Kure Island
KJ, KH3	Johnston Island
KM, KH4	Midway Island
KP6, KH5K	Kingman Reel
KP6, KH5	Palmyra
KS6, KH8	American Samoa
KW, KH9	Wake Island
KX	Marshall Islands
P2	Papua, New Guinea
T2, VR8	Tuvalu Island
VK	Australia
VK	Lord Howe Island
VK9	Willis Island
VK9	Christmas Island
VK9	Keeling, Cocos Island
VK9	Mellish Reef
VK9	Norfolk Island
VK0	Macquarie Island
VR1	British Phoenix Islands
VR1	Gilbert Island
VR1	Ocean Island
VR3	Christmas Island
VR6	Pitcairn Island
VR7	Line Island, South and Central
VR8	(See T2)
VS5	Brunei
YB, YC, YD	Borneo
YB, YC, YD	Celebes
YB, YC, YD	Java
YB, YC, YD	Sumatra
YB, YC, YD	West Irian
YJ	New Hebrides
ZK1	North Cook Island
ZK1	South Cook Island
ZK2	Niue Island
ZL	New Zealand
ZL	Auckland & Campbell
ZL	Chatham Island
ZL	Kermadec
ZM7	Tokelaus
3Q2	Fiji Islands
5W	Western Samoa

AFRICA

A2	Botswana
C5	Gambia
C9	Mozambique
CN	Morocco
CN2	Tangier
CR3	Guinea Bissau
CT3	Madeira Is.
D2, 3	Angola
D4	Republic of Cape Verde
D6	Comoros
EA8	Canary Islands
EA9	Ceuta and Melille
EA9	Ifni
EA9	Rio de Oro
EL	Liberia
ET2	Eritrea
ET3	Ethiopia
FB8W	Crozet
FB8X	Kerguelen Is.
FB8Z	Amsterdam & St. Paul
FH	Mayotte
FR	Glorioso Island
FR	Juan de Nova, Europa
FR	Reunion
FR	Tromelin
H5	Bophuthatswana
IG	Lampedusa Island
IH	Pantelleria Island
J2, FL8	Djibouti
S7	Seychelles
S8	Transkei
S9	Sao Tome and Principe
ST	Sudan
ST9	South Sudan
SU	Egypt
TJ	Cameroon
TL	Central African Empire
TN	Congo
TR	Gabon
TT	Chad
TU	Ivory Coast
TY	Benin
TZ	Mali
VK9	Heard Island
VQ9	Aldabra Island
VQ9	Chagos (Diego Garcia)
VQ9	Desroches
VQ9	Farquhar
XT	Upper Volta
ZD7	St. Helena
ZD8	Ascension Island
ZD9	Gough Island and Tristan da Cunha
ZE	Rhodesia
ZS1, 2, 4, 6	South Africa
ZS2	Prince Edward Island
ZS2	Marion Island
ZS3	Southwest Africa (Namibia)
3B6, 7	Agalega & St. Brandon
3B8	Mauritius
3B9	Rodriguez Island
3C	Equatorial Guinea
3D6	Swaziland
3V	Tunisia
3X	Republic of Guinea
3Y	Bouvet Island
5A	Libya
5H	Tanzania
5N	Nigeria
5R	Malagasy Republic
5T	Mauritania
5U	Niger
5V	Togo
5X	Uganda
5Z	Kenya
6O	Somali
6W	Senegal
7P	Lesotho
7Q	Malawi
7X	Algeria
8Q, VS9	Maldive Islands
9G	Ghana
9J	Zambia
9L	Sierre Leone
9Q	Republic of Zaire
9U	Burundi
9X	Rwanda

equipment (20 Watts output or less). External amplifiers may not be used.

3. To be eligible, all contacts must be made on or after October 1, 1978. Contacts may be made on AM, SSB, CW, or 10-meter FM. Mixed-mode contacts may also be claimed. Crossmode contacts do not qualify.

4. To qualify, a minimum of ten (10) DX countries must be worked, from the WTW DX listing. Endorsements will be given for 25, 50, 75, and 100 confirmed countries.

5. To apply, prepare a list of claimed contacts in prefix order. Include the call-sign of each station worked, the date and time in GMT, band, mode, and a brief description of the equipment used in making each contact.

6. *Do not send QSL cards.* Have your application verified by two amateurs or a notary public.

7. Award fee is $5.00 in US funds only. Endorsements are $2.50 each. Sorry, we cannot accept IRCs or foreign currency.

8. Forward your application and award fee to: Bill Gosney KE7C, *73* Awards Manager, 2665 N. Busby Road, Oak Harbor WA 98277, USA.

HAM HELP

I am looking for clear-cut information on building or buying TV-receive equipment for the low 6-GHz range.

Eugene Hertel
RR2 Hillcrest Dr.
Garden City KS 67846

I need a manual for a Collins 75A2 or 75A2A. I will pay reproduction and shipping costs.

Ken Kolthoff K8AXH/8
#2 Copper Corral
Plattsmouth NE 68048

NEW PRODUCTS

CUSHMAN CE-6488 ANALYZER

Cushman Electronics, Inc., has introduced the 6000-series model CE-6488, making the Spectrum 6000-series radio system analyzer family compatible with the IEEE-488 interface-bus standard (also know as GBIB, HP-IB, and IEC Bus).

This system analyzer offers the versatility of on-board microprocessor-based local control of the instrument for bench or site use, while also providing the ability to add a controller (and peripherals) on an IEEE-488 bus system for fully-automatic computer-controlled test routines.

By defining a computer as the controller of a CE-6488 radio system analyzer in an IEEE-488 test system, stored programs can evaluate a radio's performance and report back to you on either a display or hard-copy printout. In addition to acting as a quality gate to pass or reject a radio on the basis of the test results, the stored test programs allow operators with fewer radio skills to be effective and productive.

For additional information, contact *Cushman Electronics, 1525 Atteberry Lane, San Jose CA 95131; (408)-263-8100.* Reader Service number 477.

Cushman's IEEE-488-compatible radio system analyzer.

HEATH AUTOMATIC ANTENNA TUNER

Heath Company has expanded its amateur-radio line to include the new SA-2500 auto-tune antenna tuner. The tuner features a continuously-variable roller inductor that can be preset for 18 different frequencies.

The SA-2500 permits the user to preset high and low frequencies on each of the nine bands from 160 to 10 meters. In the auto mode, the tuner will set the roller inductor to the preselected value and automatically adjust the preset for a proper match. A remote capability allows selected frequencies to be automatically tuned to the proper swr using only the transmitter's bandswitch, provided the transmitter is equipped for remote operation.

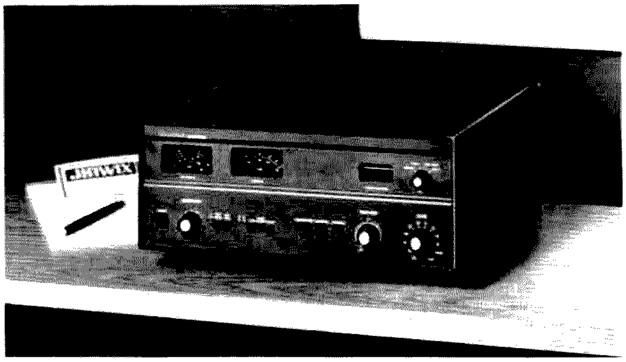
Manual tuning is made easy with three front-panel lever switches and dual wattmeters. The wattmeters read forward and reflected average power and swr in two ranges. An auto-range circuit automatically switches the wattmeters to the appropriate range.

The SA-2500 effectively tunes and matches unbalanced feedlines and single-wire antennas at the full legal power limit. The SA-2500-1 4:1 balun accessory can be added for use with balanced ladder-line antennas. A front-panel coax switch allows the user to select three different antennas or to bypass the tuner.

Heath's auto-tune antenna tuner installs directly into the transmission line to measure power on all frequencies between 1.8 and 30 MHz—200/2000 Watts in the forward direction and 50/500 Watts reflected. Swr readings on the reflected meter are from 1:1 to 3:1.

Front-panel indicators show when the roller inductor, transmitter, and antenna capacitors are being adjusted, the number of active roller inductor turns, high and low meter range, and when the tuned swr exceeds the selected ratio.

To receive more information on the SA-2500, write *Heath Company, Dept. 150-395, Benton Harbor MI 49022.* Reader Service number 478.



The Heathkit SA-2500 automatic antenna tuner.

ACE VHF MONITOR

Ace Communications, Inc., has introduced a new VHF FM monitor receiver, model AR-33. The AR-33 is a microprocessor-controlled VHF FM featherweight portable receiver. It covers 140 to 170 MHz in 5-kHz steps. Frequencies are selected by thumbwheel switches, with a slide switch for 5-kHz increments. Features include two field-programmable memory channels, high sensitivity, an OSM coaxial antenna connector, and battery operation. The receiver is 130 mm × 63 mm × 26 mm; it weighs just under 200 grams.

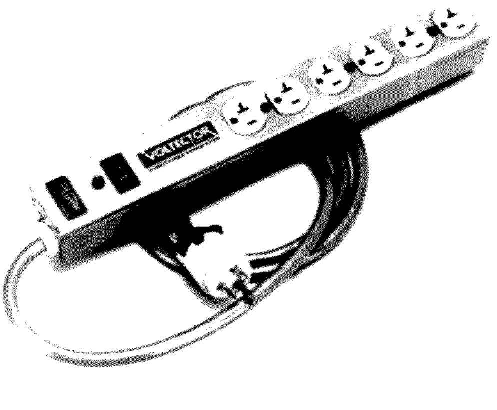
For further information, contact *Ace Communications, Inc., 22511 Aspen Street, Lake Forest CA 92630; (714)-581-4900.* Reader Service number 480.

20-AMP OUTLET STRIP

The new Volector® series 9 20-Amp conditioned power strip features heavy-duty transient-voltage surge suppression. It meets IEEE Std. 587-1980 Category A and exceeds UL-1449 requirements.

It is rated for 2500 Watts continuous duty and is available with either four or six NEMA 5-20R receptacles. These receptacles will accept both 15- and 20-Amp plugs; therefore this power strip is ideal if your total current drain is slightly over 15 Amps. The strip features a six-foot-long heavy-duty line cord, a pilot light, an on/off switch, and a resettable circuit breaker.

For further information, contact *Pilgrim Electric Company, 105 Newtown Road, Plainview NY 11803; (516)-420-8990.* Reader Service number 479.



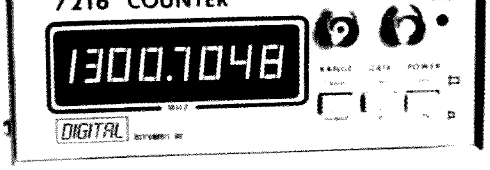
20-Amp conditioned power strip from Pilgrim Electric.

UHF FREQUENCY COUNTER

Digital Instruments, Inc. (formerly Davis Electronics), has announced their new model 7216 frequency counter. The new counter has a range of 10 Hz to 1.3 GHz and a gate time of 0.1 and 1.0 seconds at 100 MHz as well as .16 and 1.6 seconds at 1.3 GHz. The new Digital Instruments counter has a display consisting of eight .04" LEDs with an automatic decimal point. The prescaler and built-in gate light all fit neatly into the small 5½" × 6" × 2" all-metal blue case. Power requirements are 105–125 V, 50/60 Hz at 3 W, with a safe input of 120 V rms to 10 MHz and 2 V rms above 50 MHz.

Digital Instruments also produces an industrial-quality frequency counter with 1.3-GHz capability and additional features such as a proportional crystal oven, a time-base frequency of 10 MHz with an accuracy of plus or minus 5 ppm, short-term stability of plus or minus 1 ppm/hr after warm-up, and plus or minus 1 ppm at 10 to 50 degrees centigrade. The industrial-quality meter is cataloged as part number 7216A.

For additional information please contact *Digital Instruments, Inc., 636 Sheridan Drive, Tonawanda NY 14150; (716)-874-5848.* Reader Service number 476.



The new 1.3-GHz counter from Digital Instruments.

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

HUNTING LIONS IN THE AIR CONTEST

Starts: 1200 UTC January 12
Ends: 2400 UTC January 13

The contest is sponsored by Lions Clubs International and coordinated by Lions Club Rio de Janeiro Arpoador—Brazil. Participation is open to all duly licensed radio operators, Lion and non-Lion. There are two modes: phone and CW. Participation in both modes is allowed but points are counted separately. All amateur stations participating must operate within their licensing regulation. Separate categories will exist for single operators and radio clubs/societies. Multi-operators may participate as long as they do not operate simultaneously with the same prefix. However, each callsign used must be listed on the log.

Use all bands, 80, 40, 20, 15, and 10 meters. Associates of the Lions Club of Rio de Janeiro Arpoador will operate mainly within the first 50 kHz of each band and around 14,270, 21,270, and 28,270. Only one QSO with the same station on each band may be counted. Remember that phone and CW are counted separately!

EXCHANGE:

RS(T) and sequential QSO number. When contacts are made with Lions, Leos, or Lionesses, the name of the club contacted should be clearly identified.

SCORING:

QSOs within the same continent count 1 point while those between different continents count 3 points. Score 10 extra bonus points for each QSO with a member of a Lion, Lioness, or Leo Club from a different country or 5 points within the same country. Score 20 bonus points for a QSO with a member of the Lions Club Rio de Janeiro Arpoador. Contacts between Brazilian stations and members of the Arpoador club will count only 5 extra points. Contacts between members of the Arpoador club will not count any bonus points.

AWARDS:

For both categories, the Lions Club International will present trophies for first, second, and third place on both modes. For single operators, fourth through tenth places will receive plaques. In addition, each log sent by participants with a minimum of 15 contacts will receive a special certificate.

ENTRIES:

Keep a separate log for each mode. Each participant will note in the logs the callsign and information exchanged. Confirmation of contacts will be made by comparing the logs of the participants. Participants should send their logs by airmail not later than February 15th to Contest Committee, Rio de Janeiro Arpoador Lions Club, Rua Sao Francisco Xavier no. 246, Apt. 407, 22551—Rio de Janeiro-RJ-Brazil.

A5 WAS SSTV CONTEST

Starts: 1800 EST January 21
Ends: 1800 EST January 27

This is the 4th annual contest spon-

RESULTS

1984 BERMUDA CONTEST

Bermuda	
VP9IJ	2285625*
VP9TAD	356160*
VP9LE	53820
Canada	
VE3BGX	121440*
VE3MFA	40500
VE4ALO	3225*
UK	
G4CNY	376770*
G4UOF	141400*
GW4BKG	42315*
GD4HOO	36040*
G4OSY	33150*
G3UPS	16550*
G4OTU	13335*
G4FJT	12750*
G4MKT	7345*
G4GFH	6375
G4IJW	1330*
G4BYA	855*
G4RVV	775*
G3NT	660*
G3YBH	510*
G3NHF	465*
G4MTC	95*
USA	
K1RM	274890*
AD8P	232870*
N1ZZ	58320*
N3RD	37810*
KE1E	33465*
K3DH	32200*
W3MA	26100
W1DO	19080
KA1CNI	9850*
W9UP	8745*
W6HX	8160*
K4PYD	4160
W4OWJ	4070*
W3YFI	3000*
WK4F	2695
W3ARK	2205
K5KSY	2065*
WA2LWA	1975*
W9RE	1950*
W2FFQ	1925
W8DWP	1750
W5EIJ	1665*
WA5IYX	1620*
WA2LUD	1420
W9YCV	1250
W5UBW	1200*
N8CQA	1170*
KD8PT	700*
N1ATS	625
W2IP	575*
KI1B	455*
W7RIR	200*
WA1NCN	150
W9QWM	80*
W2KTF	30
W2CC	5
KB0YK	5*
Federal Republic of Germany	
DF6PK	133110*
DL6EAS	29500*
DK9IP	15565*
DL6LAG	14755*
DL3GAF	13040*
DF5IM	9960*
DF7DQ	3880*
DF3IF	3850
DL3SAW	3600*
DK5PE	3075*
DL7AHD	2865
DL1BBO	1650*
DK5DS	1590*
DL7FBZ	1580*
DF5TV	1540*
DJ0EX	1475*

* DENOTES AWARD WINNER

CALENDAR

JAN 1	ARRL Straight Key Night
JAN 5-6	ARRL QSO Party—CW
JAN 12	73 40-Meter World SSB Championship*
JAN 12-13	Hunting Lions In The Air Contest
JAN 13	73 75-Meter World SSB Championship*
JAN 19-20	73 160-Meter World SSB Championship*
JAN 19-20	ARRL QSO Party—Phone
JAN 21-27	A5 WAS SSTV Contest
JAN 26	73 15-Meter World SSB Championship*
JAN 26-27	West Virginia QSO Party
JAN 26-FEB 3	ARRL Novice Roundup
JAN 27	73 20-Meter World SSB Championship*
FEB 2-3	Vermont QSO Party
FEB 2-3	New Hampshire QSO Party
FEB 9-10	Dutch PACC Contest
FEB 16-17	ARRL DX Contest—CW
FEB 23	73 RTTY World Championship Contest
FEB 23-24	YL-ISSB Commo System QSO Party—Phone
MAR 2-3	ARRL DX Contest—Phone
MAR 16-17	YL-ISSB Commo System QSO Party—CW
MAR 16-17	Spring QRP CW Activity Weekend
MAR 16-17	Bermuda Amateur Radio Contest
MAR 30-31	Rio CW DX Party
APR 27-28	Helvetia Contest
JUN 8-9	Worldwide South America CW Contest
JUN 8-9	ARRL VHF QSO Party
JUN 22-23	ARRL Field Day

Note: Distant ARRL contest dates were still tentative at the time this list was compiled; check *QST* for any changes.

**73* contest rules published in the December issue of *73*. For entry forms or to submit an entry, send SASE(s) to the appropriate address(es) listed below:

40-Meter Contest: Dennis Younker NE6I, 43261 Sixth Street East, Lancaster CA 93535.
75-Meter Contest: Jose A. Castillo N4BAA, 1832 Highland Drive, Amelia Island FL 32034.
160-Meter Contest: Harry Arsenault K1PLR, 603 Powell Avenue, Erie PA 16505.
15-Meter Contest: Bill Gosney KE7C, 2665 N. Busby Rd., Oak Harbor WA 98277.
20-Meter Contest: Chuck Ingram WA6R, 44720 N. 11th Street East, Lancaster CA 93535.

Background Noise...

NEWSLETTER OF THE MONTH

It seems that every time I open up a newsletter, another editor is retiring. The latest is Rick Imbordino KS9V, Editor of *Background Noise*, journal of the Western Area FM Amateur Repeater Club (WAFAR). I've been reading this publication for the past several months, and I think that WAFAR will be very lucky to find someone as talented and dedicated as Rick.

Each issue of *Background Noise* is packed with information pertinent to the VHF/UHF scene, including operating news, regulatory proceedings, and equipment modifications. One of the cartoons which appeared in a recent edition is hanging on the wall here at *73*.

Rick, congratulations to you and the entire membership of WAFAR. And to all of our friends who regularly mail their newsletter to *73*, please accept our thanks and our wishes for a safe and happy New Year.

To enter your newsletter in *73*'s Newsletter of the Month Contest, send it to *73*, Pine Street, Peterborough NH 03458, Attn: Newsletter of the Month.

sored by *Amateur Television Magazine.* The object is to work as many different US states as possible on the video mode. All contacts must be in video form with a minimum of callsign and RSV signal reports sent and received. Count 10 points per SSTV OSO regardless of location, with 100 points awarded for each new state. Contacts with Alaska or Hawaii on SSTV count 500 points. The top scorer will receive a free 3-year subscription to *A5 ATV Magazine,* with 1-year subscriptions going to district leaders. All entrants will receive a special gold specialized-communications certificate suitable for framing. Logs must be sent to Contest Manager, *A5 ATV Magazine,* PO Box H, Lowden IA 52255. Indicate state and score on the front of the envelope. Logs and photos sent will be returned at the close of the contest-judging period. Results should be published in the March or April, 1985, issue of the magazine.

INTERNATIONAL RTTY ART COMPETITION

The Wireless Institute of Australia is running an International RTTY Art Competition as part of its 75th anniversary celebrations. Entries must not contain more than three overlinings and must be submitted with a hard-copy printout and Baudot tape.

Categories include: (a) best hand-generated original submitted by its author outside VK, (b) best hand-generated original submitted by its author who is a VK, and (c) best non-original hand-generated or computer-generated RTTY picture.

The completion closes August 31, 1985, and entries must be sent to: WIA 75 RTTY Art Competition, Wireless Institute of Australia, 412 Brunswick Street, Fitzroy 3065, Victoria, Australia.

RESULTS

1984 NEW JERSEY QSO PARTY

(Top scorers in boldface)

New Jersey Scores

Bergen	KA2OIW	3050
	W2CC	234
	WA2ASQ	6
Burlington	**KX2W**	32,912
	W2XQ	3500
Camden	KA2QGO	836
Cape May	K4FFM	650
Cumberland	N2BNP	315
Essex	W2SUE	2150
	K2VX	253
	WA2ASQ	110
Mercer	WB2PKG	2678
	WB2KEL	171
Passaic	WA2ASQ	1026
Salem	NC2V	3885
	WB2KMR	893
Somerset	KA2RLW+	
(multi-op)	KA2OEE	5181
	WA2WJY	351
Sussex	W2RQ	8234

Out-of-State Scores

Connecticut	**WA1NCN**	165
Maine	N1PL/1	312
Eastern Pennsylvania	WA3JXW	4
Maryland/D.C.	KA3KBZ	16
S. Florida	WK4F	66
Kentucky	**WA4EBN**	299
New Mexico	N5EZA	4
Arizona	AK7J	16
Michigan	KA8IIN	84
Ohio	KA8MPT	6
West Virginia	W8VEN	40
Kansas	N0CLV	160

WEST VIRGINIA QSO PARTY
Starts: 1700 UTC January 26
Ends: 1700 UTC January 27

Sponsored by the West Virginia State AR Council, this contest is open to single operators only.

EXCHANGE:

RS(T), serial number, and state, country, or WV county.

FREQUENCIES:

Phone—10 kHz up from lower General band edges. CW—35 kHz up from low end. Novice—35 kHz up from lower band edge.

SCORING:

Count 1 point per QSO. WV stations multiply by total WV counties, states, and countries worked. Others multiply by total WV counties worked. Multiply score by 1.5 if running 200 Watts or less.

ENTRIES:

Mail logs by February 11th along with a large SASE for results, addressed to: K8BS, PO Box 1694, Charleston WV 25326.

FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

DIGITAL QUIZ

This is hard for me to say, but I have become a total, hopeless computer addict. Friends, I have a micro on my back.

It all started very innocently about four years ago. I was walking past my local Radio Shack Computer Center when I was struck by the sudden, uncontrollable urge to buy a TRS-80 Model III. Shaking slightly, with Mastercard in hand, I entered that den of wasted souls and purchased my first computer. The salesman, dressed in his natty three-piece suit, smiled; I whimpered. Oh, for those clean and wholesome days of amateur radio. Outdoors, with one foot on the peak of my roof and the other twisted in 600 feet of #12 copper wire.

At first, I thought I would only dabble with my new toy on weekends. But soon, those idle weekends grew into idle weeks, months, and years. Now, I'm a dissipated, slobbering mess. In addition to my original Model III I've expanded my addiction to include an IBM PC, Apple IIe, TRS-80 Model 100, Atari 400, and Commodore 64. Sigh. Groan.

Like all addicts, I had to find a way to feed my evil habit (computers aren't cheap), so I became a pusher. That's right, I turned to writing computer books and magazines, both to make money and to snare additional innocent victims. I've written for nearly all of the major computer magazines, most of which are mailed to subscribers in plain brown wrappers. Heaven help me, I even write a computer column in a magazine aimed at doctors. Now, as I find myself hitting silicon bottom, I turn my attention to my favorite fraternity—radio amateurs. The result is this month's column.

Please forgive me. I'm a sick man.

ELEMENT 1 MULTIPLE CHOICE

1) A repeater that carries computer data is often called a:
 1) digipeater
 2) compupeater
 3) datapeater
 4) waste of time

2) The first popular microprocessor was:
 1) Motorola's MC6502
 2) Intel's 4004
 3) Zilog's Z-80A
 4) Kenwood's YE-1

3) Which one of the following computer languages was named after Lord Byron's daughter:
 1) Pascal
 2) Susan
 3) Ada
 4) Lady

4) The first computer, ENIAC, weighed:
 1) 30 pounds
 2) 300 pounds
 3) 3 tons
 4) 30 tons

5) Which one of the following companies never manufactured computers:
 1) General Electric
 2) RCA
 3) Toyota
 4) Singer

ELEMENT 2 TRUE-FALSE

	True	False
1) Control Data Corp. is based in New York City.	____	____
2) A popular telephone modem speed is 300 bytes per second.	____	____
3) Superconductor devices usually operate at room temperature.	____	____
4) LED displays require reflected light to view.	____	____
5) An RS-232C interface is a parallel port.	____	____
6) AMTOR is a computer language.	____	____
7) Each dot on a computer display is called a "pixie."	____	____
8) Most people also call a RAM device a "computer on a chip."	____	____
9) To start Apple Computer, Wozniak and Jobs sold an old VW beetle.	____	____
10) Model 32 Teletypes were once commonly used as computer terminals	____	____

ELEMENT 3 FILL IN THE BLANK

1) Before vacuum tubes and semiconductors, computers used ____ as logic switches.

2) ____ Univac

3) The transistor: Shockley, Brattain, and ____.

4) ____ is a program that can imitate a psychiatric interviewer.

5) The IBM PC primary microprocessor is an ____.

ELEMENT 4 MATCHING

Match the computer pioneer on the left with his achievement on the right.

1) Alan Turing	A) Data processing punch cards
2) Adam Osborne	B) Founded IBM
3) Thomas J. Watson, Sr.	C) Analytical engine
4) Herman Hollerith	D) First successful portable computer
5) Samuel Morse	E) Silicon chip
6) Charles Babbage	F) Automatic computing engine
7) Howard Aiken	G) Binary electrical code
8) Gary Kildall	H) CP/M
	I) Mark 1

THE ANSWERS

Element 1:

1—1 And they're becoming very popular.
2—2 Designed by Marcian "Ted" Hoff in 1969.
3—2 After Ada Lovelace.
4—4 It also had a power dissipation of 150,000 Watts.
5—3 Not yet anyway.

Element 2:

1—False Minneapolis MN.
2—False That's 300 *bits* per second.
3—False Most operate at temperatures near absolute zero.
4—False You're confusing LEDs with LCDs.
5—False A serial port.
6—False It's a RTTY format.
7—False Pixel.
8—False Only if they're not too smart. A random-access-memory unit contains no processing abilities.
9—False It was a VW bus.
10—False As five-level units, Model 32s were basically used for telecommunications purposes (including amateur RTTY).

Element 3:

1—Relays
2—Sperry
3—Bardeen
4—Eliza
5—Intel 8088

Element 4:

1—F, 2—D, 3—B, 4—A, 5—G, 6—C, 7—I, 8—H.

SCORING

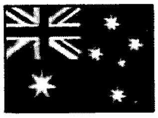
Element 1:
Five points for each correct answer.
Element 2:
Two and one-half points for each correct answer.
Element 3:
Five points for each correct answer.
Element 4:
Four points for each correct match.

How did you do?
 1-20 points—You're clean
 21-40 points—A dabbler
 41-60 points—On the road
 61-80 points—Computer junkie
 81-100+ points—In the gutter

73 INTERNATIONAL

Each month, 73 brings you ham-radio news from around the world. In this collection of reports from our foreign correspondents, we present the latest news in DX, contests, and events, as well as keep you abreast of the technical achievements of hams in other countries.

If you would like to contribute to your country's column, write to your country's correspondent or to 73: Amateur Radio's Technical Journal, *Pine Street, Peterborough NH 03458, USA, Attn: Perry Donham KW1O.*



AUSTRALIA

J. E. Joyce VK3YJ
44 Wren Street
Altona 3018
Victoria
Australia

OUR 75TH ANNIVERSARY

1985 will be a very interesting year for both VK and overseas amateurs as some of the special events planned to celebrate the WIA's 75th year as a national amateur-radio body look to be great fun for all those concerned. Every division or state in Australia is trying to do something significant towards celebrating this most special event. For example, the VK3 division has a RTTY art contest planned, among other things, with prizes for original RTTY pictures and further prizes for reproductions of classic paintings. This contest is open to all WIA members.

There has been a great upsurge in RTTY in VK3 of late, due mainly to what appears to be an unlimited supply of used Siemens 100 teleprinter machines, most of which are complete right down to the supply of paper. These machines are being sold at a very low cost—the average price being around A$50.00. As most of these machines have been checked and serviced by a volunteer group of local amateurs called "The RTTY Fixers Group," it represents an easy way for local amateurs to get involved in this aspect of amateur radio.

THE RTTY FIXERS GROUP

This is a band of dedicated RTTY operators led by Fred McConnell VK3BOU. They have spent countless hours servicing these machines and adjusting them to 45.45 baud. This group also conducts RTTY workshops at the VK3 WIA club rooms to help the newcomer learn the finer points of maintenance on these fine teleprinters.

Several of these machines have been sent to other divisions, so we can expect an upsurge of RTTY from all VK in the very near future.

Places to Look

Queensland (VK4) has a RTTY broadcast on 7.035 MHz at 1000 UTC from the Southeast teletype group, with their weekly news bulletin each Monday night.

The frequency segments and calling frequencies in Fig. 1 are recommended for use on the various amateur bands Australia-wide.

In 1983, Bill VK8ZWM, with other RTTY enthusiasts, formed a group called "The Territory Amateur Radio Teleprinter Society." They transmit a weekly broadcast on 3.555 at 0915 UTC each Sunday. This broadcast is transmitted by Mr. H. Andersson VK8HA, the Darwin Radio Club's president.

Band	Segment	Calling Frequency
160m	1825-1835	1825
80m	3620-3640	3630
40m	7040-7060	7050
30m	10140-10150	10140
20m	14070-14110	14090
17m	18100-18110	18100
15m	21075-21125	21090
13m	24920-24930	24920
10m	28050-28150	28090
6m	52080-52100	52080

Fig. 1.

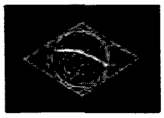
VK9Z—WILLIS ISLAND

Willis Island is active again with Andy VK9ZA, who is on his third trip there, taking over from Graham VK9ZW at the end of June. Andy is operational on most bands, including six meters. As usual, all QSLs for Willis Island operations go to Jill VK6YL, either direct or via the bureau.

QSL PROBLEMS IN VK2

Headlining the uncollected QSL problem (this time in VK2), in line with an earlier Divisional Council decision, the QSL manager of VK2 placed the following in the Public Notices section of the *Sydney Morning Herald* on Saturday, June 16, 1984!

> W.I.A. (N.S.W. Division) Q.S.L. Bureau, as from the 31st July, 1984, and regularly thereafter, all cards held at the bureau, whether for members or non-members, and unclaimed for two years, will be destroyed without further notice being given.
>
> *Signed:* D. Pearson (Manager)
> Box 73
> Teralba 2284, N.S.W.



BRAZIL

Gerson Rissin PY1APS
PO Box 12178 Copacabana
20000 Rio de Janeiro, RJ
Brazil

THE FIRST CWRL AWARD

The state of Rio de Janeiro is known around the world for the beautiful beaches it has along its coast. Among them, Copacabana, Ipanema, and Leblon, located in the city of Rio de Janeiro, are the main ones. Many cities in the state of Rio de Janeiro have their own beaches, and especially in the region called Big Lakes, we can find paradisiacal spots such as the beaches of Marica, Saquarema, Cabo Frio, and Araruama.

The amateurs of that region, headed by a group located in Araruama, established a CW group called Grupo de CW da Reglao dos Lagos, which means CW group of the Lakes Region. The group sponsors the CWRL Award, which never has been requested by any foreign station. The award is very beautiful—and the secretary, Aylton T. Campos PY1AZG, is anxious to issue the first certificate for an amateur outside Brazil. The CWRL Award is available to all licensed amateurs for confirmed contacts with: (A) 29 Brazilian stations whose first *suffix* letters form the phrase "Araruama—onde o sol passa o inverno" (which means: Araruama—where the sun spends the winter), and (B) three CWRL members (any prefix or suffix).

Contacts must have been made after January 1, 1983, on any amateur band. Only two-way CW contacts are allowed. Send GCR log of stations worked (call, date, time, band, and report) and 10 IRCs for mailing expenses to: CWRL Bureau, PO Box 91, 28970 Araruama, RJ, Brazil. There are no special endorsements for the CWRL Award.

SWL: Same rules.

CWRL members are PY1s AFA, APS, ASI, AZG, BVY, CC, COA, DPG, DEA, DFF, DGB, DJY, DMX, DQV, DWH, DWM, EBK, ECL, ER, EWN, GO, MIZ, PA, PL, QN, OP, RD, RW, TBW, TG, TO, TOZ, TZ, UZ, VEH, VMV, WXU, and YT.

Most of them are very active and 100% QSL. A few members changed their callsign suffixes of 3 letters to two letters. So, if you have any QSL of a station not mentioned above but clearly written on the QSL card, "CWRL Member," it will be good for credit.

CYPRUS

Aris Kaponides 5B4JE
PO Box 1723
Limassol
Cyprus

Summertime in Cyprus, as in every country, is holiday time. So most amateurs go on holiday either abroad or in their own country. For this reason, amateur activity was restricted and not many 5B4s were on the HF bands. However, many 5B4s were hamming, on the move enjoying their recently-approved mobile licenses or from their holiday QTHs. The fine temperate climate of Cyprus during the summer gives a chance for all from the amateur fraternity to get together outdoors on picnics and other outings.

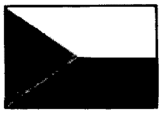
The Nicosia group had two social occasions, a dance and dinner in Nicosia and a barbecue under the Cyprus pines on Troodos mountain, where every ham showed his ability and capacity in eating and drinking. Hi!

The Limassol group also organized an excellent get-together in the wonderful surroundings of Pissouri Beach, where the blue sea, the beautiful women, the idyllic scenery, the tasty food, and especially the friendliness of all the hams and members of their families made this a 100% success. Besides the Limassol group, on this occasion were also members of the Paphos group such as Solos 5B4JX with his XYL, Maria 5B4JZ and daughter YL, Flora 5B4PO, and other friends and guests of the group.

The Limassol group also organized a second social event by having dinner and then going midnight swimming in Limassol Bay, which was also very successful.

Radio activity by Cyprus amateurs is hoped to increase during the autumn and wintertime. Quite a few HF beams have been bought, with 3 or 4 elements, and lots of young people got their licenses recently, so (I am sure) the 5B4 callsign is going to be heard regularly on the bands. Some 5B4 stations, such as those of 5B4IT, 5B4MD, 5B4MC, and 5B4NG are equipped with RTTY facilities, and very soon 5B4CV will be active with SSTV with his home-brew equipment.

Generally, during the summertime, the activity was mostly on VHF and 20m, with the occasional DXing of 5B4JE on 40m and 80m. During the winter I hope to operate more on 40m, 80m, and 180m, so readers may look for me around 7.045 MHz, 7.083 MHz, 3.795 MHz, and 1.835 MHz, or 1.850 MHz usually between 2100 and 2200 UTC.



CZECHOSLOVAKIA

Rudolf Karaba (OK3KFO ARC)
Komenskeho 1477/8
955 01 Topolcany
Czechoslovakia

CRC, PO Box 68, 113 27 Praha 1, Czechoslovakia, is giving these awards for non-European countries:

100-OK—This diploma is awarded for contacts with various OK/OL stations. The contacts are valid if since January 1, 1954. Endorsements are given for 200, 300, 400, 500, and 1000 stations. 5 IRCs and the application should be sent to CRC.

OK-SSB—This can be gained for contacts with OK stations if the number of 25 points is reached, irrespective of the date. For contacts in the bands of 28, 21, and 14 MHz there is one point. For contacts in the bands of 7, 3.5, and 1.8 MHz there are two points. 5 IRCs and the application should be sent to CRC.

Be *careful!* The following general conditions are valid for all the diplomas awarded in Czechoslovakia: In case the contacts are made in the *OK-DX Contest* (annually the second Sunday in November), it is not necessary to present QSL cards. Send only the application together with a log from the contest to CRC.

RTTY

In Brno (the capital of Moravia), two further radio clubs, OK2KBR and OK2KFR, have been put into operation on RTTY. They use teletypewriters RFT T-51 and our T-100; converters have been operating together with active filters. OK2BFS had tested the Intel 85 microprocessor system and found out that a high-frequency field from the transmitter, 250 Watts, does not matter. It cannot be said, however, about ZX-81, where 30 Watts was obstructive.

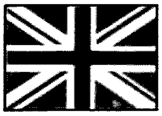
AMSAT-OSCAR 10

The number of DXCC countries which have appeared when operating AO-10/B has increased to 102 (for the last time thanks to the DXpedition to San Marino—T77A, T77C, T77U).

Excessive trespassing of recommended erp has been continuing further on. For these reasons, for example, here in Czechoslovakia RSGB bulletins broadcast by GB2RS on AO-10/B with a prescribed erp cannot be understood. Therefore, "crocodiles" usually roar with the intensity of S8!

At present, 4 stations have been working actively in the region of East Slovakia: Ondrej OK3AU from Kosice, Stano OK3ZFA from Poprad, Viktor OK3LW from

Michalovce, and Fero OK3FH from Presov. OK3AU heard, by means of AO-10/B, another station from New Zealand. It was ZL1TFI. Unfortunately he did not establish any contacts this time either.



GREAT BRITAIN

Jeff Maynard G4EJA
10 Churchfields
Widnes WA8 9RP
Cheshire
England

THE UK SCENE

The major news on the UK amateur scene at the time of writing is the issue by the Department of Trade and Industry (the UK regulatory body) of the new amateur license schedule. The schedule takes the form of an annex to the main license and defines the detailed technical constraints within which the licensee's station must be operated.

I have written before of the love of bureaucracy in the UK establishment, particularly those parts involved in the issue, control, and regulation of licenses related to radio broadcasting in any shape or form. Those of you who thought that a revised 1984 license schedule might be couched in plain English can return to your drawing boards. Lovers of legalistic jargon can rest easy!

I won't bore you with extensive quotations from the complete schedule (reproducing it fully would take up all my column space), but you may be interested to know of some of the restrictions placed on UK amateurs.

Perhaps the main change (certainly in terms of the number of words) is the adoption of the revised symbols for classes of emission as defined by the International Telecommunications Union (ITU) in Geneva in 1982. Now we have to write J3E in the log when using single-sideband transmissions, or F3C for some types of facsimile transmission. The schedule adds to the confusion by listing the permitted types of transmission by frequency band in simple terms (such as Morse, telephony, RTTY, and so on).

This same chart lists the "status of allocation" for each band; in other words, it defines the basis under which each particular band is available for use by amateurs. These range from simple definitions such as "Primary" and "Secondary" to "Secondary, Users must accept interference from the ISM allocation in this band," and "Secondary, This band is not available for use within the area bounded by 53N 0ZE, 55N 0ZE, 53N 03W, and 55N 03W."

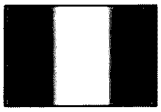
UK amateurs need to be good at geography as well as everything else!

Antenna buffs may also like to know that the schedule explains that erp (effective radiated power) is used below 1 GHz and eirp (effective isotropically radiated power) above 1 GHz. It adds (helpfully?) that eirp is 2.1 dB greater than erp.

I don't know whether or not it's coincidence, but within days of publication of the new schedule, the DTI agreed to supply the RSGB with statistics relating to successful prosecutions under the new Telecommunications Act.

NASA astronaut Tony England W0ORE visited RSGB HQ recently and outlined his plans to repeat W5LFL's earlier shuttle mission. I do hope he has thought of a new way to institute and conduct QSOs. I wrote previously of the debacle on 2m when a million lids tried simultaneously to cause chaos (and largely succeeded, I might add).

The RSGB has just published an up-to-date list of QSL bureau sub-managers, which prompts me to reflect on the effort put in by this dedicated bunch. The RSGB QSL bureau is free to all RSGB members. Outgoing cards are sent to a single point for distribution to overseas bureaux. Incoming cards, though, are handled by no less than 58 sub-managers, each of whom deals with a particular range of calls. For example, my incoming cards, as for all cards in the range G4EAA to G4EZZ, are handled by G8OPA. The volume of mail such work must generate, to say nothing of the need for storage and sorting space, requires a certain dedication not found easily. I can well imagine some of the bureau sub-managers spending more time sorting QSL calls than conducting QSOs.



ITALY

Mario Ambrosi I2MQP
Via Stradella, 13
21029 Milano
Italy

ITALIAN AWARDS

The rules of the Marco Polo Award already have been published in *73* and here is the follow-up of the results of North American stations. The US leader is WB3CQN with 151 points, followed by WA3HUP with 148 points and WB4UBD, 131 points, W7ULC, 129 points, and N3KR, 87 points.

Also, the rules of the Italian Islands Award have been in *73*. It is not an easy certificate, but a couple US stations have managed to get it. They are N3BGY and W1RFW for the moment, but we are waiting for more applications considering that this summer there has been much activity from the islands and many contacts have been made with Ws.

ISLANDS FOR VACATION

Italy is surrounded by the sea and, particularly in the south, there are large and small islands. It has become a habit here to take the holidays during July or August and to go south. Many of the people working in the big industrial towns originate from the south and they just go back to see the relatives and the birthplace. The others go simply for the beauty of the coasts and of the sea, for the nice food, and for the sun (Sicily is on the same line as Algeria or Tunisia). So when the big factories close for 3 or 4 weeks (all of them together, unluckily), millions of cars take the speedways to the south.

I remember a friend in Los Angeles showing me a traffic jam and saying it was an American invention. I am sorry to say that here it has become an art. You can spend hours traveling at just 10 mph while the speed limit is 90.

The distance from Milano to Sicily is 1000 miles, more or less, and you have to cross the sea and then make another short trip inland and then take another boat if you want to get to one of the beautiful islands surrounding Sicily. But when you arrive you can really rest, enjoy the wine and the fish, sail, look for girls, and perhaps spend some time with the radio.

This is becoming more and more popular since the start of the Italian Island Award, and this summer it was possible to work more than 10 different islands in the different seas.

One of the operations has been from the Tremiti group with the callsign I2DMK/IL7. He has activated all 5 islands of the group, as each one is valid for the award. The largest of them is San Domino—where a population of 70 becomes 1000 during summer.

Another good prefix was IA5DFS, during July, the same period as the mini-expedition of I2PFY/ID9 and ID7UDB.

In August, it was possible to catch IM0LYN, I3ON/ID9, IT9ZRQ/IG9, IT9HLO/IF9, I2KAJ/IG9, IP1GJK, and IM0WON.

The photo shows the Linosa camp in the IG9 group, activated during August.

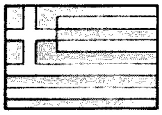
It has become a popular sport to do some ham radio from an island, and it will be the same again next year; if you want any details please write me, and if you plan to come to Italy next summer, I can put you in contact with some of the local people. You will surely enjoy the warm southern people.

THE FIRST YL STATION FROM 3V8

From July 27 to August 8 there was an operation from Tunisia with the callsigns 3V8ZY and 3V8AI. Operators were Dieter IN3RZY and Angela, his wife, IN3XAI. They have operated from the shack of 3V8PS, the only station in Tunisia, of which Dieter is the QSL manager.

Angela is the first YL who has been active from Tunisia and therefore has been much requested on the air. They had 6600 QSOs with 140 countries worked and very poor propagation. You can QSL to their home address. The operation has already received the OK from the ARRL desk.

3V8PS has been in Tunisia a couple of years and is very active on all bands, mainly SSB. He works with an ICOM 720 and a 2-element beam, so his signal is not too strong, but he has managed to get 230 countries and is always looking for a new one. It's very easy to find him at 14213 kHz talking to his manager. The photo shows Angela in the garden of the house.



GREECE

Manos Darkadakis SV1IW
Box 23051
Athens 11210
Greece

By the time you read this, the Radio Am-

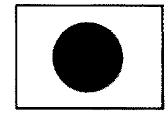
The DXpedition camp on Linosa Island.

Angela IN3XAI in Tunisia.

ateur Association of Greece will be at a new address. So people who would like to contact RAAG officials will now have to use the address: RAAG, 23-24, Platia Eleftherias, 105 53 Athens, Greece. The offices will be on the third floor, but at the time of writing I don't know the new phone numbers. I will pass them along in my next column. Keep in mind that you can always use the address: RAAG, PO Box 3564, 102 10 Athens, Greece, as this one is not changing.

When on the band you hear a J4 prefix, don't panic and start looking at your DXCC Countries List for the new one. It is Greece, alright, and this prefix is given on special occasions such as contests, celebrations, etc. By the way, in the last WPX contests, some of my SV fellows participated, and from the first results according to *CQ* magazine, it looks like Greece is going to have (for the first time in our amateur history) a winner as the top European scorer. The station is J41JG (or SV1JG, if you like). You may remember Cliff from my presentation in this column a few months ago. He scored 1,667,576 points, and as the evaluation of the contest logs still goes on at *CQ* headquarters, we don't know the final results, but I have a strong feeling that they will bring to J41JG the reward. Cliff was 10th in the single-operator, all-band category last year, and if he is not going to be the continental leader for this year, I'm sure he will have some similar position. Anyway, I still have my fingers crossed!

I have written this column for about a year now and you have probably noticed that I never mentioned anything about awards. Well, up to now (since a few years ago) Greece is not issuing any awards at all. There have been some in the past, but for a very complicated reason which is difficult to explain in these lines, they have stopped for maybe 6 years now. Anyway, as this all belongs to the past, there is a big effort for some new awards which will start again this RAAG's dead and buried activity.



JAPAN

Roy Waite W9PQN
Tomigaya Grand-301, 2-19-5 Tomigaya
Shibuya-Ku
Tokyo 151
Japan

EARTHQUAKE

Until now, most offers by amateur-radio operators to assist in disasters in this country have been spurned or met with scoffs or outright ridicule. After all, "amateurs" are not "professionals" and are not really qualified, and they might even get in the way and impede the professionals in aiding the public during disasters—so the argument went. But is ham radio in this country finally coming of age?

In the early morning of September 14, 1984, a death-dealing earthquake registering six on the scale struck an area north of Tokyo (specifically, the village of Ohtaki in Nagano Prefecture). The thing to note here is that on September 18th, the Asahi newspaper, with a national circulation of over 9,000,000 (!), reported on the situation with a headline that announced, "...POOR EMERGENCY COMMUNICATIONS...HAM RADIO TOOK OVER!" That kind of publicity can't be bought at any price.

In recent years, ham radio, long thought by the general public to be the exclusive domain of schoolboys, has been gradually gaining attention and respect, much of that due to the JARL's singular efforts. Especially effective have been the articles regarding satellite communications, which seem to capture the imagination of laymen everywhere. But in Japan there is not a great amateur emergency network like RACES, that we have in the United States. Part of this is due, of course, to apathy on the part of the amateur-radio community, but mostly it is due to ignorance on the part of society as to just exactly what part amateur radio could play. And those who are apathetic can't be blamed either. As one Japanese ham told me, "No need to waste your effort trying to convince the local officials. We've tried, but they won't listen." But this may change now, although gradually, no doubt, as most changes in this country take half an eternity.

Anyway, let's get back to the Asahi story. The newspaper report explains that the residents of the village of Ohtaki, where the residences are scattered at the foot of Ontake Mountain, were actually all "tied together" with the village office by wire—in other words, a sort of public address system where the city officials make public announcements from time to time to the 427 families living there. There was also an ordinary telephone circuit. But when the quake hit, it hit with such force and magnitude that most of the poles holding the wires were either toppled or tilted, ripping out the wires for the entire system, including power lines.

Nearby, 140 employees of the Forestry Bureau who work in the mountains and forests in various scattered locations all escaped to safety. They were the main and most effective rescue group, as many of them are ham-radio operators. They, of course, played a major role in guiding citizens to safety and summoning help.

During the past few years, Ohtaki village had been considering the installation of an emergency radio communications system, but had not yet accumulated enough funds in the village budget.

Soon after the quake hit, some of the wired communications were restored, but three days later some homes were still without communications of any kind. There are some 40 wireless stations throughout the village including mobile stations in the fire engines. Base stations are located in the village office and in a public hall in the Takigoshi area in the far west. But Takigoshi couldn't use its transmitter because they are not equipped with a generator—and the power lines were down there, too. Therefore, 120 people in that area were completely isolated from the outside world.

There was one active radio emergency circuit between an adjacent city office in the prefecture and Ohtaki, but it was tied up continuously, talking to various departments and prefectural offices, and couldn't really give much information on damage areas and where help was needed. Here is where ham radio came to the rescue.

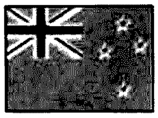
The forestry employees, located in several different areas, communicated with each other by ham radio on UHF as soon as it became apparent that a devastating earthquake was in progress. Some at first tried to get to the disaster areas in their vehicles, which are equipped with ham rigs, and made contact with other hams in Ohtaki, the hardest hit area. It soon became apparent that vehicles would be of little or no use as the quake had damaged many of the roads to the extent that they were no longer passable. As one observer put it, "The roads were all cut up." So they proceeded on foot to the hardest hit areas, reporting on the situation through their hand-helds as they walked.

This mobility enabled the various forestry groups to summon help and advise of areas where there were high-velocity landslides in progress, sudden swelling of streams and rivers, other areas to avoid, safe evacuation areas, areas that were not passable, and determining the areas where help was not needed and to recruit help from those areas and direct those people to places where immediate help was needed. The ham rigs of these forestry people became the main emergency network. Some hams in the village refrained from transmitting, but carefully noted the information they heard and passed it on to the village officials and others in charge of disaster rescue operations. One important link was a forestry station location at midpoint that acted as relay between points where signals were weak.

Because of the efforts of these men and their ham rigs, many people were able to escape to safety and many others were pulled from rubble and mud, resulting in saved lives. In spite of these commendable efforts, two weeks after the quake hit the toll was 8 dead and 21 missing, which gives us an idea how strong and destructive an earthquake it was.

Departing from the Asahi newspaper report, my own comments are that I would hope that this story might encourage ham groups to once again resume their efforts to form emergency groups. Each Field Day (in Japan it's the first weekend in August) is well attended by various eager groups around the country. I wonder how many people realize that the real intended purpose of Field Day is to practice emergency communications?

It is a sad commentary on us human beings that it often takes violent events such as death and destruction to open our eyes and hearts. It would even be sadder if, in spite of that, we did nothing.



NEW ZEALAND

D. J. (Des) Chapman ZL2VR
459 Kennedy Road
Napier
New Zealand

A very busy month at this QTH! What with weekend conferences for a first aid organization that I am concerned with, a reunion of old retired Post Office Mail Section employees in Auckland, where I worked in the Mail Section for 30 years, and being installed as first principal of my chapter, I haven't had much time to research a special topic for the column. However, I have borrowed a few paragraphs from our local amateur magazine, *Break-In*, that I thought might prove of interest to 73 readers.

BITS 'N' PIECES

AMSAT-UK was host recently to an amateur satellite planning meeting at Cheltenham, England. Representatives from European and worldwide satellite groups were present, including G3YJO, W3GEY, DJ4ZC, KA9Q, KE3D, HA5WH, W4PUJ, NK6K, VE1SAT/VE6, G8DQX, DK1YQ, ZS6BNT, and ZL1AOX. The group discussed many topics and technologies pertaining to satellites, as well as information dissemination and fund raising. The formation of an "Amateur Satellite Service Council" was proposed to expedite the topics discussed with representation from all bona fide amateur satellite groups worldwide. Further details of this Council will be provided when the draft proposal is refined.

From the meeting in England, Ian ZL1AOX, VE1SAT/VE6, KA9Q, and DK1YQ went on to Marburg, Germany (headquarters of AMSAT-DL) for an intensive Controller Command training session with Karl Mainzer DJ4ZC. As a result of the training, Ian and the others are now authorized to undertake the full range of attitude and control commands associated with the long-term control of OSCAR 10. A major advantage of the increased number of command stations is that the general beacon information can now be updated weekly, bringing more information more quickly to eagerly-awaiting users.

Special Victorian Callsign—From early November, the call VK3WI will be heard on all bands in SSB, CW, and RTTY. This call will be operated by the Wireless Institute of Australia (Victorian Division) to commemorate the 150th anniversary of the State of Victoria. The call will be used for a period of approximately six months. QSL to VK3WI, 412 Brunswick Street, Fitzroy, 3065, Australia, or via the Bureau.

Changes in Vanuatu—The Vanuatu P and T Department is to tighten up on licensing procedures in the Republic and, in addition, carry out stiffer policing of radio operations within the Territory. The YJØ prefix will be allocated to nonresident and short-term bona fide amateurs who can produce documentary evidence from one of the major countries that have amateur status. Long-term residents, including expatriates on long-term employment, will continue to be allocated two-letter calls with the YJ8 prefix. The YJØ calls will consist of three suffix letters in the series YJØAAA to YJØAAZ. Any marine mobile (.../MM) calls will be valid for use only within Vanuatu waters.

From ZK-Land—Victor ZK1CG has been operating on RTTY with gear kindly donated by Gin JA1ACB, but unfortunately is off RTTY for a while until he acquires a green or amber screen monitor, then he will be back on the air on RTTY again.

Victor and his XYL, Marsha, are Mine Hosts of Tiare Village Holiday Chalets near the airport of Rarotonga and Avarua town. Included in the amenities offered by Tiare Village is the hire of ham radio to any licensed operator. Write to Victor Rivera at Box 489, Rarotonga, if you desire information to obtain a ZK1 license for use on a Rarotongan holiday. Take your own 2-meter gear to work via OSCAR.

The March of Time—It is 60 years since the first contact between Ivan O'Meara 2AC and C. Braggio CB8 in Argentina on May 22, 1924, and Frank Bell ZL4AA's two-way contact with American 6BCB on September 21, 1924, and also his two-way contact with Cecil Goyder 2GZ on October 18, 1924!

VHF Activity—6-meter activity in this area has finally slowed down to the expected level for a "minima" sunspot year. Only sporadic-E, tropo, and meteor-scatter propagation noted, with only VK, ZL, and FK8 being worked consistently. The VK2RSY beacon was copied in New Plymouth on several occasions during the late-May to mid-July period with good signal strengths ranging from 5 × 4 through to 5 × 9 + 10 dB, giving a good indication of sporadic-E propagation between ZL and VK on those occasions. ZL DX on 2 meters was minimal during this period, but a surprising amount of tropospheric duction-type of propagation still took place, and could be monitored by watching the 2m beacons and FM repeaters.

Exams—The first of the new-style amateur examinations mentioned in a recent column has come and gone; from local comment in this area, the candidates seem happy with the format, and to this

date no adverse comments have been heard. Time will tell, though, especially when the results come out, as that's when most of the postmortems take place.

OTC Silent Keys reported this month are Henry Bunn ZL1JY, ex ZL1HO and ZL2SU, on July 23, 1984, aged 78, W. (Bill) Crook ZL4LT at Milton, Otago, another long-serving amateur, and Anthony Blake ZL1RQ, on July 18, 1984, aged 71 years. All these old-timers had had many years of active service in the ranks of amateur radio in New Zealand.

I trust that all readers enjoyed a very happy Christmas and that the coming New Year will be prosperous, happy, and bountiful for all. As I have said before, we are in the midst of our summer here in this hemisphere, enjoying long sunny days and pleasant evenings—I trust you all in the north are having a reasonable holiday period, too.

Happy New Year to all from us here "down under" in ZL-land.

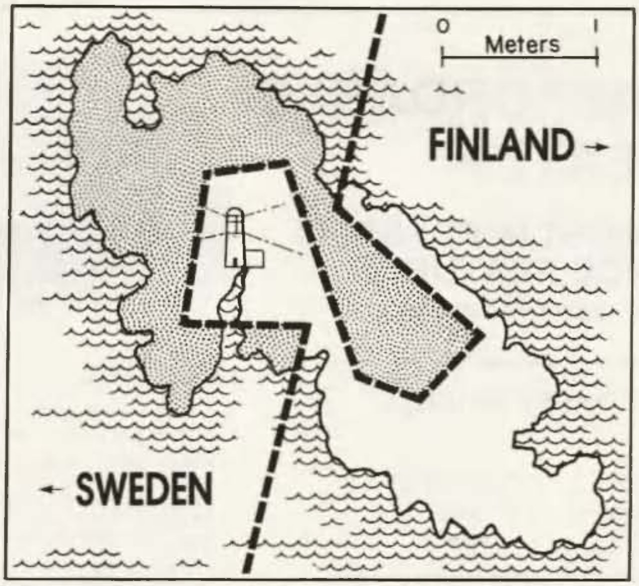


Fig. 1.

POLAND

Jerzy Szymczak
78-200 Bialogard
Buczka 2/3
Poland

Debaters attending electoral meetings taking place in clubs and District Boards of PRAA rightfully appreciated the work of many hams—activists under hard conditions of martial law. The majority of members of District Boards were reelected delegates to the National Congress of PRAA that took place at the end of 1984. Actual members of Presidium and Headquarters of PRAA took part in electoral meetings to make notes of demands for the State Radio Surveillance, the Ministry of Communications, and PRAA itself. Participants of the assemblies brought forward first drafts of improvements of an inadequate organization, an acceleration of the technical information turnover. They discussed a possibility of giving Polish hams access to the new amateur bands, 10, 18, and 24 MHz, and demanded facilities for working on another QTH without special permission. They wanted to take for granted a QRZ in motion at least on UHF.

Serious financial difficulties, particularly of poorer clubs, brought discussion on the problem of an increase of membership fees.

The Deputy Chairman of the PRAA in charge of tecnhical matters, Jerzy Niewada SP7HF, died on April 26, 1984.

Ryszard Reich SP4BBU resigned his office of the Deputy Chairman of PRAA Headquarters in charge of organization affairs. Wiktor Chojnacki SP5QU took the office.

April 8–13, 1984, the general conference of the 1st Region of IARU took place in the hotel Costa Verde (Sicily). Prof. Dr. Eng. Andrzej Zielinski SP5LVV, the President of PRAA, and Assistant Prof. Dr. Janusz Konopka SP5JC, the Microwave Manager of PRAA, represented Poland at the conference. Moreover, Wojciech Nietyksza SP5FM, Vice-President of the Executive Committee of the 1st Region, M. Eng. Henryk Cichon SP9ZD, the President of the working group in charge of electromagnetic compatibility, and M. Eng. Krzysztof Slomczynski SP5HS, the President of the working group in charge of amateur radiolocation, were present, too. Wojciech Nietyksza of the 1st Region was reelected the Vice-President.

In March and April this year there took place successive UHF competitions, "Activity Day SP." Inspired by PRAA, it brought together 150 radio stations on 144 MHz and 8 stations on 432 MHz (in March) and 142 stations on 144 MHz, 8 stations on 432 MHz (in April). In the March contest, senior category, winners were SP6GZZ, SP6AZT, and SP2DDV and junior category, SP3MFI, SP3MFJ, and SP3MLK (on 144 MHz). On 432 MHz, senior, SP6AZT, SP6GWN, SP9BGS, and SP9EWO won. SP6MLK worked on 432 MHz in the junior category.

In the April contest on 144 MHz, senior category, winners were SP6GZZ, SP3GCL, and SP6AZT, while SP3MFI, SP3MIE, and SP3MFJ won in the junior group. On 432 MHz, senior, SP6AZT, SP6GWN, and SP6CIY won. As in the previous month, only one junior was on 432 MHz, SP6MLK. After competitions, SP6GZZ had 3442 points and SP3MFI had 1271 points in the 144-MHz category, and SP6AZT had 63 points in the 432-MHz category.

SWEDEN

Rune Wande SM0COP
Frejavagen 10
S-155 00 Nykvarn
Sweden

MARKET REEF OJ0 NOW IN FINLAND

For over 90 years a Finnish lighthouse has been standing on the Swedish side of the small rocky island called Market Reef, 300 meters long and 100 meters wide, in the Baltic Sea between the Swedish mainland and Aaland Island, Finland. the border line was drawn after the peace treaty in 1809 when Sweden had to give up possession of Finland to Russia. In 1875, Finland built a lighthouse on this reef, which happened to be placed on the Swedish part of the island.

Every 25 years national border lines are checked over. Not until the latest check, in 1981, was the discovery made that Finland was using a part of the Market Reef that in fact belonged to the Royal Kingdom of Sweden! Now, in 1984, this problem has been settled and the border line has been redrawn (see Fig. 1). The amateur-radio operations from OJ0, valid as a separate DXCC country, will from now on be from the correct side of the national border!

CW ACTIVITY GROUP

In 1974, a group of Scandinavian radio amateurs formed the Scandinavian CW Activity Group, SCAG. During the early seventies, there was a noticeable decrease in ham activity on the low-frequency shortwave bands here. Two possible reasons were the introduction of 2-meter FM repeaters and the new code-free VHF license. The forming of SCAG was intended to give new enthusiasm to the low-band activity, especially on CW.

Message Handling

Due to the restrictions put on the ham operators in Region 1, we have very few possibilities in making our activities recognized by the authorities and the general public. Most countries have a state monopoly for telecommunications. This has made sending of radiograms between third parties through ham radio impossible. However, SCAG started nets for message handling for practicing purpose.

In contrast to the USA, we do not regard another ham operator as a third party. This makes it possible for us to relay messages to other ham operators in our nets. In a possible emergency it is important that all participants in a net are familiar with the procedures in order to get messages handled efficiently. If you have no practice, the risk is that you mess it all up. In the beginning some hams here were afraid of participating because they thought it would not be accepted by the authorities. However, the licensing authorities in the Scandinavian countries have stated that the way SCAG handles messages, for hams, between hams, does not violate the third-party restriction in the radio regulations. Unfortunately, in the USA a ham operator not contacted directly is regarded as a third party. This makes it impossible for us to expand our nets on a broader basis.

Four times a year SCAG issues a newsletter. The editor, Borge OZ2NU, has been doing a good job through the years. The new editor now is Gunnar SM6AWA and the president for the group is Holger SM7GNF.

SCAG was started by some dedicated Swedish hams, and among those working hard to get the activities going were Frasse SM5TK, Sven SM0IX, and Kjell SM0CCE. Further on, some Danish hams got interested and Eric OZ8O and Rick OZ5RM have over the years kept SCAG growing in Denmark. For some reasons, difficult to pinpoint, the Norwegian and Finnish hams have not been hooked by this SCAG idea and only a few LA and OH hams are members of the group.

SCAG activities include Straight Key Day twice a year with increasing popularity, rag-chew and slow-speed nets, and nets for message handling. From time to time the group arranges other activities and issues various awards like Worked SCAG Areas and SCAG Rag-Chew Award. SCAG Net Manager, Rolf SM6NFF, is trying to start a DX net with the USA and Canada on 14.055 MHz at 1430 UTC Sundays.

The SCAG motto is to support and encourage amateur radio telegraphy and to work for good operating behavior on the ham bands. The group celebrated its 10th anniversary in 1984 and will continue its efforts in bringing more hams closer together.

HAM HELP

I would like to hear from anyone who has converted a Cobra 146GTL to 10-meter SSB/AM, or a Cobra 21XLR to 10-meter FM.

Robert Good N9FFF
6134 SE 89th St.
Berryton KS 66409

I need several items: parts for an HP-608, an address for the Jerrold Antenna Corporation, and service manuals for an IBM model B typewriter and a 3M model 149 copier.

Kevin Neal
Route A, Box 221A
Flippin AR 72634

I need the manual, schematic, and parts list for the Millivac Instruments, Inc., model 77B dc multimeter. I also need the attachment that goes to the panel jack marked Output. I will gladly pay mailing and/or copying costs.

Vernon Jones WB1BVH
32 Cat Mousam Road
Kennebunk ME 04043

I am in desperate need of a shop manual for a Motorola Multi-XFL portable repeater. It is possibly an SP version of the Lookout repeater and was manufactured in 1973. I'll pay all costs incurred.

Derek W. Kelly
100 Sylvan Court
Alexandria VA 22304
(703)-765-5227

DEALER DIRECTORY

Culver City CA

Jun's Electronics, 3919 Sepulveda Blvd., Culver City CA 90230, 390-8003. Trades 463-1886 San Diego, 827-5732 (Reno NV).

Fontana CA

Complete lines ICOM, DenTron, Ten-Tec, Mirage, Cubic, Lunar, over 4000 electronic products for hobbyist, technician, experimenter. Also CB radio, landmobile. **Fontana Electronics, 8628 Sierra Ave., Fontana CA 92335, 822-7710.**

San Jose CA

Bay area's newest amateur radio store. New & used amateur radio sales & service. We feature Kenwood, ICOM, Azden, Yaesu, Ten-Tec, Santec & many more. **Shaver Radio, Inc., 1775A S. Winchester Blvd., Campbell CA 95008, 370-6665.**

New Castle DE

Factory Authorized Dealer! Yaesu, ICOM, Ten-Tec, KDK, Kenwood, AEA, Kantronics, Santec. Full line of accessories. No sales tax in Delaware. One mile off I-95. **Delaware Amateur Supply, 71 Meadow Road, New Castle DE 19720, 328-7728.**

Boise ID

Rocky Mountain area's newest ham dealer. Call RJM first for AEA, Azden, KDK, Ten-Tec, Butternut, Cushcraft, and more! **RJM Electronics, 4204 Overland, Boise ID 83705, 343-4018.**

Preston ID

Ross WB7BYZ has the largest stock of amateur gear in the Intermountain West and the best prices. Call me for all your ham needs. **Ross Distributing, 78 So. State, Preston ID 83263, 852-0830.**

Littleton MA

The reliable ham store serving NE. Full line of ICOM & Kenwood. Yaesu HTs, Drake, Daiwa, B&W accessories. Curtis & Trac keyers. Larsen, Hustler, Telex-Hy-Gain products. Mirage amps., Astron P.S., Alpha Delta protectors, ARRL & Kantronics instruction aids. Whistler radar detectors. Full line of coax fittings. **TEL—COM Electronic Communications, 675 Great Rd. (Rt. 119), Littleton MA 01460, 486-3400/3040.**

Lincoln NE

G&C Communications is a full-line distributor of major-line amateur equipment and accessories, antennas, and everything. **4230 Progressive Ave., Lincoln NE 68504. 46-RADIO.**

Derry NH

Serving the ham community with new and used equipment. We stock and service most major lines: AEA, Astron, Azden, B&W, Cushcraft, Hy-Gain, Hustler, ICOM, Kenwood, KLM, Larsen, Mirage, Mosley; books, rotors, cable and connectors. Business hours 9–7 Monday through Thursday, and 9–5 Friday and Saturday. **Rivendell, 68 Warner Hill Road, Derry NH 03038; 434-5371.**

Albany, New York UPSTATE NEW YORK

Kenwood, ICOM, Ten-Tec, Belden, Cushcraft, Larsen, Hustler, ARRL, Hy-Gain, B&W, MFJ, Mirage. New and used equipment. Serving the amateur community since 1942. **Adirondack Electronics, Inc., 1991 Central Avenue, Albany NY 12205, 456-0203** (one mile west of Northway exit 2W).

Columbus OH

The biggest and best ham store in the Midwest featuring Kenwood and other quality products with working displays. We sell only the best. Authorized Kenwood service. **Universal Amateur Radio, Inc., 1280 Aida Dr., Reynoldsburg (Columbus) OH 43068, 866-4267.**

Dallas TX

IBM PC/XT kits, supplies, expansion products; video restorer kits for pay TV, CATV, satellite hobbyists' electronic project kits/app-notes. More than 9000 parts in stock: semiconductors, ICs, discretes, video accessories, tools, audio, automotive, cabinets, computer peripherals. Please write for your free 60-page catalog. **Sabet Electronics, 13650 Floyd Rd., Ste. 104, Dallas TX 75243; 783-4950 (formerly I.E.).**

DEALERS

Your company name and message can contain up to 25 words for as little as $150 yearly (prepaid), or $15 per month (prepaid quarterly). No mention of mail-order business or area code permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the April '85 issue must be in our hands by February 1st. Mail to 73 Magazine, Peterborough NH 03458. ATTN: Nancy Ciampa.

PROPAGATION

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15						20	20A	15			
ARGENTINA	20										15	15
AUSTRALIA	20					40	40			20	20	15
CANAL ZONE	40	40					20	15	15	15	15	20
ENGLAND	40	40	40	80	80		20	15	15	15	20	
HAWAII	20					40	20	20			15	15
INDIA							20	20				
JAPAN	15						20	20				15
MEXICO	40	40	40	40	40	40	20	15	15	15	15	20
PHILIPPINES							20	20				
PUERTO RICO	40	40	40	40	40	40	20	15	15	15	15	20
SOUTH AFRICA	40A	40						15	15	20		
U. S. S. R.		40						15	15	20		
WEST COAST	15	20	40	40	40	40	40A	20A	15	15	15	15

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20				40	40	20	20				20
ARGENTINA	20	40	40	40						15	15	20A
AUSTRALIA	15					40	20	20	20		15	15
CANAL ZONE	20		40	40	40			20	15	15	15	15
ENGLAND	40	40	80	80				15	15	15	20	
HAWAII	20	20			40	40	20	20	20	15	15A	15A
INDIA								20				
JAPAN	20				40	40	20	20				20
MEXICO	20		40	40	40			20	15	15	15	15
PHILIPPINES	20							20	20			
PUERTO RICO	20		40	40	40			20	15	15	15	15
SOUTH AFRICA	20	40	40						15	15	15	20
U. S. S. R.		40	40					15	15	20		

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	15	20			40	40	40				20
ARGENTINA	20	20		40	40						15	15
AUSTRALIA	15	15	20				40		20	20	20	15
CANAL ZONE	20	20		40	40	40	40	40	15	15	15	15
ENGLAND			40	40					20A	20A		
HAWAII	15	20	20			40	40	40				15
INDIA		20	20									
JAPAN	15	15	20				40	40	40			20
MEXICO	20	20		40	40	40	40	40				15
PHILIPPINES	20A	20								20		
PUERTO RICO	20	20		40	40	40	40	40				15
SOUTH AFRICA	20	20							15	15	15	20
U. S. S. R.								20	20	20	20	
EAST COAST	15	20	40	40	40	40	20	20A	15	15	15	15

A = Next higher frequency may also be useful.
B = Difficult circuit this period.

G = Good, F = Fair, P = Poor.

JANUARY

SUN	MON	TUE	WED	THU	FRI	SAT
		1 G	2 G	3 G-F	4 F-P	5 P
6 F	7 P-F	8 F-G	9 G-F	10 F	11 G	12 G
13 G	14 G	15 G	16 P	17 P	18 F	19 P-F
20 F	21 F-G	22 G	23 G	24 G	25 F	26 P
27 P	28 P-F	29 F-G	30 F	31 F-G		

International Edition

February 1985 Issue #293
$2.50 USA / $3.00 Canada

73®

Amateur Radio's Technical Journal

A CWC/I Publication

6 New Projects!

HF Helicals?
Page 42

Swr Fraud Exposed!
Page 32

TY

Cheap Chip Checker
Page 60

6-Meter CB?
Page 22

Easy OSCAR Amp
Page 18

Package Pointers
Page 44

Trans-Tester—60

VIC RTTY Resource
Is your VIC-20 ready for RTTY? Make it happen with N5ALE's foolproof software! ... N5ALE 12

Satellite Supremacy
Sometimes 15 Watts just doesn't cut it with OSCAR 10. The solution? Use W2GEF's 60-Watt uplink amp—stripline construction makes building it a snap! ... W2GEF 18

CB to Six
Why stop at 10 meters? KB5LF's Hy-Gain conversion will take you to VHF just as easily. ... KB5LF 22

Future Schlock
The strange tale of the KA5S experiment. Was he a genius or a madman? ... KA5S 30

Swr: A Modern Myth?
From rig to radials, noted expert W6YUY reveals the path to a perfect antenna system. Be ready for a few surprises. ... W6YUY 32

Ollie's Folly
Circular polarization on HF? A forty-meter helix with oil-drum forms? W1ZB's signal runs rings around the rest. Folly, indeed! ... W1ZB 42

Build a Better Box
Most hams cram their circuits into any old case that's handy, but a little planning can turn a so-so project into a masterpiece of packaging ... W4RNL 44

Super Surplus Surprise
It's super: 50 Watts on 160, 80, 40, and 30 meters! It's surplus: That means inexpensive! It's the GRC-9: Still surprised? ... K9RLF 54

The Texas Trans-Tester
Here's how to measure small-signal gain with a transistor checker you've built from scratch ... KG5B 60

Ollie's Folly?—42

What?—4
Never Say Die—6
QRX—9
Barter 'N' Buy—62
Letters—62
Ham Help—66, 67, 85
Special Events—65
New Products—68
Review—70
RTTY Loop—71
DX—72
Satellites—73
Be My Guest—74
Corrections—74
Reader Service—80
Contests—82
Fun!—84
73 International—86
Dealer Directory—94
Propagation—94

73: Amateur Radio's Technical Journal is a member of the CW Communications/Inc. group, the world's largest publisher of computer-related information. The group publishes 53 computer publications in 24 major countries. Nine million people read one or more of the group's publications each month. Members of the group include: Argentina's *Computerworld/Argentina*; Asia's *The Asian Computerworld*; Australia's *Computerworld Australia, Australian Micro Computerworld, Australian PC World* and *Directories*; Brazil's *DataNews* and *MicroMundo*; China's *China Computerworld*; Denmark's *Computerworld/Danmark* and *Micro Verden*; Finland's *Mikro*; France's *Le Monde Informatique, Golden* (Apple) and *OPC* (IBM); Germany's *Computerwoche, Microcomputerwelt, PC Welt, Software Markt, CW Edition/Seminar, Computer Business* and *Commodore Magazine*; Italy's *Computerworld Italia*; Japan's *Computerworld Japan* and *Perso ComWorld*; Mexico's *Computerworld/Mexico* and *CompuMundo*; Netherland's *CW Benelux* and *Micro/Info*; Norway's *Computerworld Norge* and *MikroData*; Saudi Arabia's *Saudi Computerworld*; Spain's *Computerworld/Espana* and *MicroSistemas*; Sweden's *ComputerSweden, MikroDatorn, Min Hemdator* and *Svenska PC World*; the UK's *Computer Management, Computer News* and *Computer Business Europe*; the US's *Computerworld, Hot CoCo, inCider, InfoWorld, MacWorld, Micro Marketworld, Microcomputing, PC World, RUN, 73* and *80 Micro*.

INFO

Manuscripts

Contributions in the form of manuscripts with drawings and/or photographs are welcome and will be considered for possible publication. We can assume no responsibility for loss or damage to any material. Please enclose a stamped, self-addressed envelope with each submission. Payment for the use of any unsolicited material will be made upon acceptance. All contributions should be directed to the *73* editorial offices. "How to Write for *73*" guidelines are available upon request. US citizens must include their social security number with submitted manuscripts.

Editorial Offices:

Pine Street
Peterborough NH 03458
Phone: 603-924-9471

Advertising Offices:

Elm Street
Peterborough NH 03458
Phone: 603-924-7138

Circulation Offices:

Elm Street
Peterborough NH 03458
Phone: 603-924-9471

Subscription Rates

In the United States and Possessions:
One Year (12 issues) $24.97
Two Years (24 issues) $38.00
Three Years (36 issues) $53.00

Elsewhere:

Canada and Mexico—$27.97/1 year only, U.S. funds. Foreign surface mail—$44.97/1 year only, U.S. funds drawn on U.S. bank. Foreign air mail—$79.97

To subscribe, renew or change an address:

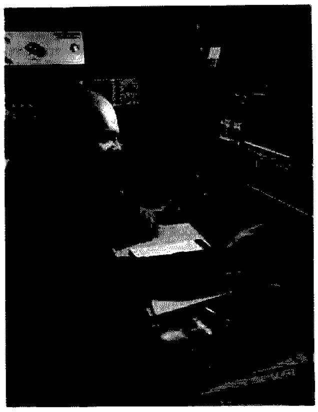
Write to *73*, Subscription Department, PO Box 931, Farmingdale NY 11737. For renewals and changes of address, include the address label from your most recent issue of *73*. For gift subscriptions, include your name and address as well as those of gift recipients.

Subscription problem or question:

For questions concerning your subscription and to place subscription orders, please call us toll free at 1-800-645-9559 between 9 am and 5 pm or write to *73*, Subscription Department, PO Box 931, Farmingdale NY 11737.

73: Amateur Radio's Technical Journal (ISSN 0745-080X) is published monthly by CW Communications/Peterborough, Inc., 80 Pine Street, Peterborough NH 03458. Second class postage paid at Peterborough NH 03458 and at additional mailing offices. Microfilm Edition—University Microfilm, Ann Arbor MI 48106. Postmaster: Send address changes to *73*, Subscription Services, PO Box 931, Farmingdale NY 11737. Nationally distributed by International Circulation Distributors.

W2NSD/1
NEVER SAY DIE
editorial by Wayne Green



HAM-DAY

With the electronic, computer, and communications fields jumping ahead, American know-how must really be keeping the Patent Office hopping, right? Just imagine the wealth of American patent applications our labs and research firms must be making—plus those from independent inventors.

I checked with the Patent Office to see how things were going. In 1984, they had 19,677 applications—a bit less than I'd imagined. Of those, only 4,876 were from Americans. And of those, only a small percentage were in electronics and communications—most were consumer products. The fact is, most of the patents approved during the last ten years have been Japanese, not American.

Amateur radio is one of the best high-tech hobbies, so if we can interest more people in getting ham licenses, the chances are that we'll eventually get more scientists, engineers, and technicians—and then more inventions.

The Japanese strength in amateur radio has helped Japan completely defeat America in consumer electronics—ham equipment, CB, hi-fi, VCR, and so on. If we can start generating more hams, perhaps we can hope someday to catch up with Japan. It's going to be tough with their starting out at around four times as many hams as we have, and with half our population!

Okay, how can *you* help? It isn't enough to sit around wringing your hands and cursing the fates—or even cursing the League, if you think that they brought this disaster upon our country, costing us hundreds of billions of dollars and seriously weakening our defense effort. The fact is that YOU can help.

Ham-Day—March 24th—a Sunday. Now, what are you going to do on Ham-Day? You are going to work either by yourself or with your local ham club to expose as many people to amateur radio as you can. This means inviting friends to your home and making some contacts so they'll see what is involved. Clubs can organize group visits to ham shacks—preferably shacks where good DX contacts are possible.

I'm not talking about setting up a table in a mall and taking messages. I don't think I've ever seen a shopping-mall ham demo which the general public could understand. No, people need to see a ham shack in a home and be able to talk with either some DX operators or even to some other similar visitors a few hundred or thousand miles away.

Now, get on the air and make sure that every station you talk with knows that March 24th is *the* day—that whether they are in Swaziland or Newark, they are to plan to be on the air March 24th and have visitors in the shack. Let's make this the biggest visitor's day in the history of the hobby.

You may want to set up some schedules to impress your visitors. Why leave everything up to chance? You know the implacable rules of fate as well as I; everything will go wrong and you'll look like an idiot. Well, why not load the dice with some skeds? It doesn't cost extra.

THE FCC

Did you miss seeing a copy of the article in the *Washington Post* about the Morse code? Pity. It was headlined, "Morse Code Operators Becoming Relics of Past." Makes you really proud to be a relic, right? The article pointed out that except for a few backwaters of communications, Morse has been dead for years.

Continued on page 66

QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, 80 Pine Street, Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

STAFF

EDITOR
Wayne Green W2NSD/1

EXECUTIVE/MANAGING EDITOR
Susan Philbrick
ASSISTANT MANAGING EDITOR
Steve Jewett
TECHNICAL/INTERNATIONAL EDITOR
Perry Donham KW1O
EDITORIAL ASSISTANTS
Nancy Noyd
Richard Phenix
Chris Schmidt
DESIGNERS
Diane Ritson
Linda Drew
ASSOCIATES
Robert Baker WB2GFE
John Edwards KI2U
Bill Gosney KE7C
Chod Harris VP2ML
Dr. Marc Leavey WA3AJR
Bill Pasternak WA6ITF
Peter Stark K2OAW

ADVERTISING
1-800-441-4403
SALES MANAGER
Jim Gray W1XU
ASSISTANT SALES MANAGER
Nancy Ciampa
SALES REPRESENTATIVE
Ross Kenyon KA1GAV

GRAPHIC SERVICES DIRECTOR
Christine Destrempes
MANUFACTURING MANAGER
Susan Gross
TYPESETTING MANAGER
Dennis Christensen
FILM PREP MANAGER
Robert M. Villeneuve
PHOTOGRAPHY MANAGER
Nathaniel Haynes

VICE PRESIDENT/GENERAL MANAGER
Debra Wetherbee
VICE PRESIDENT/FINANCE
Roger Murphy
ASSISTANT GENERAL MANAGER
Matt Smith KA1IEI
ASSISTANT TO VP/FINANCE
Dominique Smith
MARKETING MANAGER
Pamela Esty
DIRECTOR OF CIRCULATION
William P. Howard
ASSISTANT CIRCULATION MANAGER
Frank Smith
DIRECT AND NEWSSTAND SALES MGR.
Raino Wirein
1-800-343-0728
DIRECTOR OF CREDIT SALES AND COLLECTIONS
William M. Boyer

PUBLISHER
John C. Burnett

QRX. . . .

EDITED BY PERRY DONHAM KW1O

Rocky Road

A LONG, HARD BATTLE is drawing to a close in Burbank, Illinois. In 1982 the Chicago suburb of Burbank enacted an ordinance that virtually froze ham radio in its tracks. Among other things, the ordinance: required registration of all radio antennas (with proof of insurance), suspended the issuance of amateur and CB antenna permits for one year, and declared that any interference by a transmitter to any device was unlawful, with a penalty of up to $1000 for each day of violation! After two and one half years, the city and the personal radio community have reached a settlement in the form of a Consent Decree, in which the city agreed to repeal the offensive legislation. In its place, Burbank will enact a milder form of the ordinance, one that places far fewer restrictions on what are recognized (at least in Burbank) as fundamental Constitutional rights.

India Invite

LOOKING FOR INDIA ON 75? Then VU2CVP and VU2DVP are looking for you. They can be found nightly near 3.895 MHz, listening down 100 kHz. The pair is also available for skeds and may be reached via their *Callbook* addresses.

Bird Heard

THE MYSTERIOUS SATELLITE that appeared recently in the amateur 13-cm band has been identified as not one, but two new Soviet early-warning systems. W4HHK, WB5LUA, and Dick Flagg of the Kittering Group tracked down the twin birds, which have been identified as Cosmos 1547 and Cosmos 1604. Since hams are only secondary users of this band, there's not much we can do about the problem. Bob Atkins KA1GT suggests that the satellites be used as beacons to help test and align ham equipment.

W8HXR

JERROLD SWANK W8HXR has passed away at the age of 80. Since 1919 he had frequented the amateur bands, constantly giving of himself to help others in need. His station served the victims of earthquakes and floods, and, through thousands of phone patches, the lonely bases of the Antarctic. Jerry is perhaps best known for his book, *The Magic of Ham Radio*, in which he recounted his many exploits and outlined the history of our hobby. The bands will never be quite the same.

Nice NARCs

BILL BURDEN WB1BRE of the Nashua (NH) Area Radio Club wrote us a nice note detailing a fundraiser recently completed by his group. Bill was one of our "Space Shuttle Special" reporters during W5LFL's historic flight. Instead of wasting his payments on frivolous things like radio equipment, he donated the cash to NARC, which used it as seed money for a charity raffle benefiting the Shriners Boston Burn Unit. The club donated a grand total of $1572 in 1984. Now *that* is community service.

Hello, Radio

NEVER SAY DIE goes on the air! We'll be putting W2NSD/1 on the bands every Tuesday at 2200 UTC. Look for us around 14.255 MHz and up. We're willing to chat about anything you like, but keep in mind that we can't discuss business over the air. Of course we have QSLs—thousands of them—and you can have one for the price of a contact. See you on twenty!

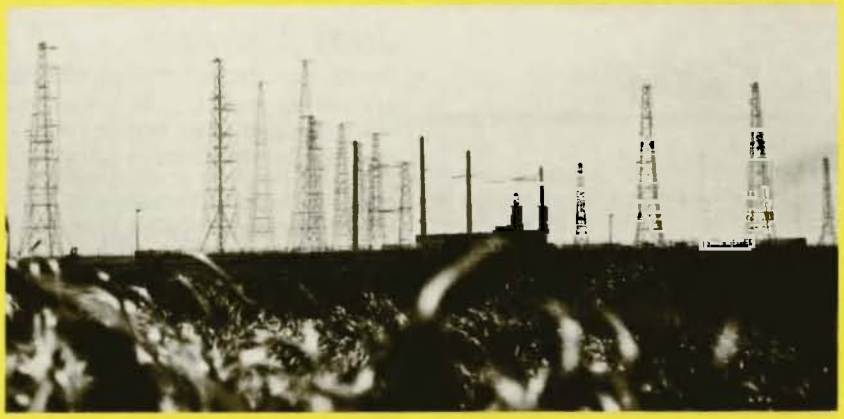
Big, BIG Gun!

RADIO NETHERLANDS fans will have a chance to talk back to their favorite shortwave broadcaster on February 16th and 17th, when PA6FLD will be active from Radio Netherlands' new Flevo transmitter site. Just so everyone will be sure to hear the station, the hams will be using Radio Netherlands' giant curtain array—one of the largest directional antennas in the world! Plans call for both SSB and CW operation, beginning at 0600 UTC February 16th and ending at 1800 UTC February 17th. Specific frequencies have not yet been announced, but you shouldn't have any trouble finding the station...simply tune around until your antenna begins to get warm!

Ben Akins KB1FJ (left) presents Ray Palmer a check for $1017.

CLASS Act

CHRYSLER CORPORATION has come up with a really CLASSy item. CLASS, or the Chrysler Laser Atlas and Satellite System, uses the government's NAVSTAR satellite network to monitor the location of your vehicle. By precisely measuring the time it takes various signals to reach your car's antenna, the system can determine your vehicle's position to within a few feet. This information is displayed as a glowing, moving



Radio Netherlands' giant Flevo transmitting site.

dot on a laser-disk-generated map. A microcomputer automatically changes maps as you move from area to area. Incredibly, the feature adds just $500 to the price of a new automobile!

Tank You

"A LITTLE DIFFERENT" is the way **Erv Carrigan KA8EKG** describes his shack (see photo). On the surface, Erv's place looks like a typical radio room, with maps and flags and modern gear. But it's not *on* the surface, and that is what's so unusual. According to Erv, "My shack is built in a cistern eight feet under ground, with eight inches of reinforced concrete overhead and 12 inches of limestone blocks on all sides, except where I made a door." Erv's ham career started when he was 71 with a Novice license and continued with a General ticket at age 73! His is certainly one of the strangest locations I've seen...can you top (or bottom) it?

Generals QSY

GENERAL-CLASS OPERATORS can now check into AMSAT nets. The frequency has been changed to 3.855 MHz, and the three nets (east coast, midwest, and west coast) still meet at 9 pm local time.

Brewers

THE HOMEBREW III JUDGES, weary from wading through the flood of excellent contest entries, have made their decision. The winner, and recipient of our $250 Grand Prize, is **Alan Smith W8CHK** for his entry, "A Something-for-Nothing Commodore 64 RTTY Interface." Look for Alan's article in a future issue of *73*. Second place, and a $100 prize, goes to **Kevin Jones KA8RCJ** for "The Five-Dollar Six-Element Delta Loop." Our three runners-up, each receiving a $50 bonus, are **Paul Bunnell KE6VK, Hugh Wells W6WTU,** and **Hank Goldman WA2OVG.** Congratulations, guys! And a big "thank-you" to all of those who entered this year's contest, making it one of our biggest and best ever.

Ice Ladies

YLs HAVE INVADED VK0-land. **Robyn VK0AK** will be based at Mawson in Antarctica and **Denise VK0YL** will be on Macquarie for the next year or so. Robyn plans to be active on all bands, using VK2DES as her QSL manager. We don't have QSL information for Denise yet; we'll pass that along as soon as it is made known.

OX3FS

73 HAS JUST LEARNED that Finn

Erv KA8EKG in his subterranean shack

Steenstrup OX3FS has passed away in a tragic accident involving the giant radio dish at SRI/Greenland. Finn was instrumental in the effort to save the crippled UoSAT-2 spacecraft, using the super-sensitive SRI receiving system. By tracking the local-oscillator emissions of the bird, technicians were able to accurately plot orbital data which led to the reactivation of the satellite. Ironically, it was this antenna that Finn was working on at the time of the accident.

"01110101"

A NEW AMATEUR MODE will be offered in the very near future by **National Communications Group (NCG).** Their just-announced 220-MHz multimode rig features CW, SSB, FM, and...*digital audio!* That's right, a 25-kHz-wide digital-audio mode is included in a package that runs under $550. Delivery is expected in mid-1985, and you can look for a preview of the rig at the Dayton bash coming up in the spring.

Glass Fist?

MORSE SENDING TESTS are optional, according to the FCC. The latest set of VEC instructions allows for a Morse sending test in addition to the required receiving exam. The FCC has for many years given only a receiving test, feeling that this was adequate proof of proficiency in the code. International law requires sending *ability*, but does not stipulate an actual sending test.

Just Kidding . . .

DOCTOR DX made a house call recently when **Mike Lamb N7ML,** President of AEA, visited his daughter's class at school. Mike introduced the group of 4th, 5th, and 6th graders to the wonders of ham radio. Below are excerpts from some of the thank-you letters he received (verbatim).

- "Thank you for taking the time to visit us...I would like to be an amicher radio man when I grow up."—David
- "At the end of your visit I became interested in being a ham radio operator. Although it would cost a couple houndred dollars it would be fun."—Steve
- "Thanks for coming to our classroom and talking about how it works. (sorry I forgot the name of it!)"—Aaron
- "...you tawght us alot about Morris codes...I'm really Interested In being a ham."—Katie
- "Thank you for coming to our classroom. Even though I missed the presentation. I wanted to see it."—Maret
- "I thank you so very, very, very, so very much. I learned very much about Hand Radio Operators. When I grow up I want to be a Hand Radio Operator."—Michelle

As you can see, the kids *really enjoy* learning about ham radio!

Pie Slicing

THE LAND MOBILE SERVICE has been awarded 41 MHz of UHF spectrum. In a recent FCC action, allocations in the 800–900-MHz range were divvied up between the Land Mobile Service, various broadcasters, satellite communication vendors, and the US Department of the Interior. It is hoped that the allocations will help ease some of the pressure from commercial concerns to take over the amateur 220-MHz band.

Spotters Spotted

TED PAUCK K8NA wrote to tell us of a DX repeater operating in southeast Michigan. K8NA/R may be found on 144.53/145.13 MHz and is intended for contest spotting and DX information. Ted thinks we should compile a list of DX repeaters in the form of a directory. OK, why not? If you have information about a DX-oriented repeater in your area, send it along to "QRX" and we'll make a mini-directory available for an SASE.

Split Decision

CALIFORNIA'S SOUTHERN TIER might be joining many western states in adopting the 20-kHz two-meter repeater band plan. With their backs to the sea and with surrounding states already implementing the plan, the Southern California Two Meter Area Spectrum Management Association has begun a feasibility study to determine the effect of making the switch. Such a move could force northern California repeater systems to fall in line with the rest of the Pacific Northwest states already using 20-kHz splits. Another important state, Texas, will vote on the band plan this month. How far to the east can the wave roll before hitting a brick wall?

Thanks!

DON'T FORGET to send in your news items, comments, and photographs to "QRX." This month we had help from *Westlink*, the *W5YI Report*, WA6ITF, WB1BRE, *220 Notes*, *Amateur Satellite Report*, and scores of our friends who support "QRX" with their cards and letters.

VIC RTTY Resource

Is your VIC-20 ready for RTTY?
Make it happen with N5ALE's foolproof software!

R. L. Hudgins N5ALE
Rt. 1, Box 1254
Kountze TX 77625

The purpose of this article is to provide all the information you will need to put your VIC-20 computer on RTTY and ASCII for very little money. The programs allow transmit and receive on RTTY and ASCII with message storage in the RTTY program and CW ID in both programs. The user-port connections are included and will work with any interface you care to use.

The introduction of the VIC-20 computer spurred a sudden growth of interest in VHF computer operation and the simple ASCII program was developed to take advantage of that. The RTTY program was developed for those who don't have enough available money to purchase the more expensive packages but still want to run RTTY.

While no standard has been set here in southeast Texas, I am hoping that I can hook enough people with the RTTY program so that some will start using 110-baud ASCII on VHF, and by general use, set ASCII as a standard for VHF. The ASCII programs take up less memory and run faster than RTTY. This makes little difference at slow speeds such as 60 wpm, but as data rates increase and we go to more automated modes of communication, it will become very important. For those of us who never see a program or device that can't be improved upon, the program description will help, I hope.

I can't claim that all parts of the program were original. The CW ID routine is modified slightly from a program produced by Kinetic Designs, 401 Monument Rd. #171, Jacksonville, Florida 32211. The RTTY program from Kinetic Designs is very

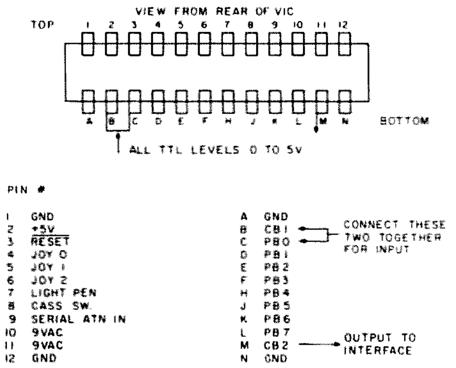


Fig. 1. This is the view of the user I/O port on the right side of the VIC as viewed from the back, with pin descriptions.

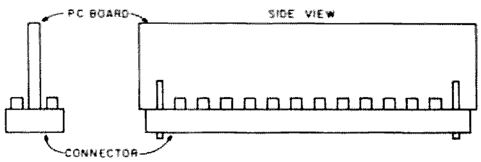


Fig. 2. This is the view of the connector after the PC board is epoxied in between the two rows of pins. The two long objects at either end are long #6 machine screws. These help strengthen the back board and provide good anchors for epoxying. Also it may be useful to mark the top and bottom of the edge connector with a permanent marker of some kind.

good but requires an 8K memory expander. I highly recommend their software if you have the extra memory. It has quite a few extra features.

The RTTY program follows a fairly simple outline. Line numbers 50 through 112 are for variable setup. The open statement opens the RS-232 port which is built into the VIC. It also sets the speed and handshaking for the program. In line 110, the dimension statement sets the heart of the program, the array that holds the data for converting Baudot to ASCII and back again for transmit.

The actual receive routine starts on line 130 where the get # statement brings in the Baudot code, and if there is nothing there, it goes to line 200 to check for keyboard input. Lines 140 through 142 convert the Baudot code to a number and check for control characters for letters and figures. If they are detected, a variable is set and the program loops back to get the next character.

Line 150 is the Baudot-to-ASCII conversion where the actual value to be printed on the screen is looked up in the data tables. If the program is in the letters mode and an A is received, the number returned in variable RB is 3, which is the Baudot code for A. This is then added to the value in variable SH, which for letters is 1, to give you the fourth character in data line 1000. This is the number 65, which is the ASCII code for A. Lines 160 to 550 print the value on the screen and check for transmit, speed change, and CW ID control characters.

The transmit routine starts on line 700. Lines 700 through 710 set the heading and speed and check for control and out-of-range characters. Lines 715 and 718 check to see whether the character is a letter or figure, transmit the proper Baudot control character, and set the variable F to the proper value for the data encoding through line 719. Line 719 is the reverse process of the receive function in line 150. Line 720 is included so that after 72 characters are transmitted, a line feed and carriage return are transmitted so that the program will be compatible with the older mechanical Teletypes®. Line number 750 actually sends the Baudot character.

I had thought about stopping with the simple transmit and receive sections, but I decided that message and CW ID capabilities were really needed. The messages start at line 805. I put a CQ call in the first buffer, which is started by pressing the F1 key. You can substitute any message you want there and then continue it in line 806. Just be sure to keep the message between the quotes and end the line with GOTO 820. Otherwise, your message will go off by itself and never come back. The second message buffer is called with the F2 key and starts on line 810. It is handled the same as the first. Don't forget the GOTO on 812.

The call in line number 2230 is "DE N5ALE." To change this, replace the code between the quotes with "DE your call" in Morse code, using the period and the minus keys. Also, all spaces are transmitted, so be sure to provide a space between DE and the call.

As you read the program, you will see some odd symbols. The symbol in line 116 is the shifted clear/home key. The heart in line 500 is the shifted S; the symbol in line 530 is the shifted W; the symbol in line 706 is a shifted I; the symbol in line 707 is a shifted R. To call the transmit routine, press the shift S. The CW ID is shift I and the messages are called with the F1 and F2 keys. The CW ID and messages are only reached from the transmit routine, and after the CW ID, the program returns to the receive routine. The speed-change section is called with shift W from both transmit and receive.

When typing this program, it will be necessary to abbreviate all commands and use other techniques to save memory. These standard abbreviations are found in the personal computing book that comes with the VIC. These are on page

```
2 PRINT"J R.L.HUDGINS" FORJ=1TO1000 NEXTJ
4 PRINT"▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮   ASCII" FORJ=1TO500 NEXTJ PRINT PRINT
10 REM ASCII 110BAUD
21 PRINT"BAUD 110=131.300=134"
22 INPUT F%
30 REM 224=SPACEPARITY,FULL DUPLEX
100 OPEN2,2,3,CHR$ (F%)+CHR$(224)
110 GET#2,A$
200 REM MAINLOOP
210 GETB$
211 IFB$=CHR$(133)THENGOSUB2200
225 IFB$<>""THENPRINT#2,B$;
230 GET#2,C$
240  PRINTB$,C$;
250 SR=ST IFSR=0THEN200
370 CLOSE2 END
2200 REM CW ID
2202 XM=37148 N=192 F=224 XX=3 PRINT""
2203 FORI=1TO10 MM=PEEK(37150) NEXTI
2204 IFMM>146THENPRINT"STAND BY..." GOTO2203
2206 PRINT"CW ID..."
2208 FORI=1TOTM NEXTI
2210 ID$="-.. .    " REM*DE
2220 GOSUB2300
2225
2230 ID$="-. ..... .- .-.. . " REMCALL (N5ALE)
2235
2240 GOSUB2300
2265 POKEXM,238 PRINT"OK"
2270 GOTO110 REM RETURN
2300 REM*SEND
2310 FORI=1TOLEN(ID$)
2320 X$=MID$(ID$,I,1)
2330 IFX$="."THENMM=10
2340 IFX$="-"THENMM=30
2350 IFX$=" "THENFORJ=1TO30*XX NEXTJ GOTO2370
2360 POKEXM,N FORJ=1TOMM*XX NEXTJ POKEXM,F
2370 FORJ=1TO10*XX NEXTJ
2380 NEXTI RETURN
```

ASCII program listing.

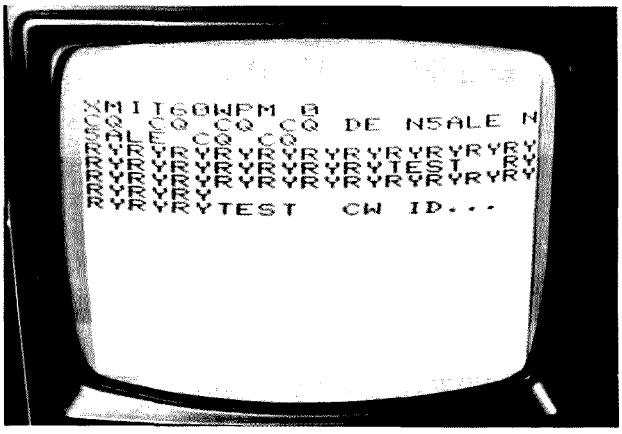
```
50 PRINT"J    RTTY "
60 PRINT"     N5ALE"
70 PRINT"  R.L.HUDGINS"
100 OPEN2,2,3,CHR$(102)+CHR$(16) GET#2,RC$
110 DIMAA%(64),BA%(59) FORI=1TO64 READAA%(I) NEXTI FORI=1TO59 READBA%(I) NEXTI S
H=1 F=0
112 H=666 L=665 POKEL,211 POKEH,87 WP$="60"
116 CL$="J                       " MA=0 S=1 AS=0
117 PRINT"J"CL$"RCV"WP$"WPM"
130 GET#2,RC$ IFRC$=""THEN200
140 RB=ASC(RC$)
141 IFRB=27THENSH=33 GOTO130
142 IFRB=31THENSH=1 GOTO130
150 RD%=AA%(RB+SH) RD$=CHR$(RD%) IFRD$=CHR$(13)THEN130
160 PRINTRD$, GOTO130
200 GETK$ IFK$=""THEN130
500 IFK$="♥"THEN700
530 IFK$="o"THENGOSUB2500 GOTO117
550 GOTO130
700 PRINTCL$"XMIT"WP$"WPM"J F=1
704 GETK$ IFK$>CHR$(132)ANDK$<CHR$(135)THENGOSUB800
705 IFK$=CHR$(13)THENGOSUB760
706 IFK$="<"THENGOSUB2202
707 IFK$="_"THEN117
708 IFK$="o"THENGOSUB2500 GOTO700
710 IFK$<" "ORK$>"Z"THENGOTO704
715 IFK$<"A"THENF=31 IFS=1THEN PRINT#2,CHR$(27), S=0 GOTO719
718 IFK$="A"ORK$>"A"THENF=31 IFS=0THENPRINT#2,CHR$(31), S=1
719 D=ASC(K$) D=D-F O=BA%(D) PRINTK$,
720 AS=AS+1 IFAS=72THENAS=0 GOSUB760
750 PRINT#2,CHR$(ABS(O)), IFMA=0THENGOTO704
755 RETURN
760 PRINT#2,CHR$(2), PRINT#2,CHR$(8), PRINTCHR$(13), AS=0 RETURN
800 MA=1 Z=ASC(K$)-132 ONZGOTO805,810
805 MB$="CQ CQ CQ CQ DE N5ALE N5ALE CQ CQ "
806 MB$=MB$+"    " GOTO820
810 MB$="RYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRY"
812 MB$=MB$+"TEST " GOTO820
820 FORQ=1TOLEN(MB$) K$=MID$(MB$,Q,1) GOSUB705 NEXTQ
860 MA=0 RETURN
1000 DATA0,69,0,65,32,83,73,85,0,68,82,74,78,70,67,75,84,90,76,87,72,89
1010 DATA80,81,79,66,71,0,77,88,86,0,0,51,0,45,32,0,56,55,0,36,52,0,44,33
1020 DATA58,40,53,34,41,50,35,54,48,49,57,63,38,0,39,47,59,0
1500 DATA4,13,17,20,9,0,26,11,15,18,0,0,12,3,28,29,22,23,19,1,10,16,21,7,6
1510 DATA24,14,30,0,9,0,25,0,3,25,14,9,1,13,26,20,6,11,15,18,28,12
1520 DATA24,22,23,10,5,16,7,30,19,29,21,17
2202 XM=37148 N=192 FF=224 XX=2
2203 FORI=1TO10 MM=PEEK(37150) NEXTI
2204 IFMM>146THENPRINT"STAND BY..." FORI=1TO2000 NEXTI GOTO2203
2206 PRINT"CW ID..."
2230 ID$="-.. .    -. ..... .- .-.. . "
2240 GOSUB2310
2265 POKEXM,238
2270 GOTO117
2310 FORI=1TOLEN(ID$)
2320 X$=MID$(ID$,I,1)
2330 IFX$="."THENMM=10
2340 IFX$="-"THENMM=30
2350 IFX$=" "THENFORJ=1TO30*XX NEXTJ GOTO2370
2360 POKEXM,N FORJ=1TOMM*XX NEXTJ POKEXM,FF
2370 FORJ=1TO10*XX NEXTJ
2380 NEXTI RETURN
2500 PRINTCL$"60,66,75,100 WPM" INPUTWP$
2505 IFWP$="60"THENPOKEL,211 POKEH,87 RETURN
2510 IFWP$="66"THENPOKEL,236 POKEH,79 RETURN
2520 IFWP$="75"THENPOKEL,67 POKEH,70 RETURN
2530 IFWP$="100"THENPOKEL,72 POKEH,53 RETURN
2540 GOTO2500
```

RTTY program listing.

133. Another thing that may be done to save memory is to put no spaces between variables and other characters, even between the line number and the statement. This will not affect the listing, which will print the whole command on the screen, but will save some memory.

The program will convert to the Pet or CBM computer very easily. The only things that will present any trouble are the POKEs and PEEKs. I will try to detail all of them to make it easier. The first POKEs are in line 112. These are 665 and 666, which are for baud control in the RS-232 port. The next is a PEEK in the CW ID routine on line 2203. This is 37150, which is the interrupt register that is checked to see if all characters have been sent from the RS-232 transmit buffer. The value of XM is set to 37148 in 2202 and POKEd in 2265 and 2360. This address is for the peripheral-control register. The value POKEd in the peripheral-control register determines which bit is turned on and turned off. This is CB2, which is the output line for the RS-232 port.

The ASCII program is a very simple version of the RTTY program with only the CW ID as an extra feature. The speeds are 110 and 300 baud and are selected when the program is run. Type in either 163 or 166 and hit the return key. If you desire to send graphics, the values in line 21 will have to be changed so that eight bits, not seven, are transmitted. This can be done by changing 163 to 131 and 166 to 134. Remember, though, that this will work only between two VICs since the graphics symbols and their ASCII codes are not standard between computers. I doubt if the other computers will make much sense out of what comes from your end unless you stick to the seven-bit standard.



Sample transmission.

Both programs have room left in them for added features. The RTTY program has about 500 bytes of memory left after running. If you check the free memory before running, it will appear to have almost 1500 bytes left, but this is misleading because the open statement grabs 500 bytes and the dimension statement grabs another 500 bytes. The ASCII program has even more room to add features if you desire.

The connections for the interface are detailed in Fig. 1, but I will go over them for clarity. The input to the VIC-20 should be on pins C and B of the user I/O port; that is, C and B should be wired together on the connector and then connected to the TTL output of the interface. Pin A is ground and should be brought out to the interface. Pin M is the data line out of the VIC to the interface. That's all that is needed to connect the VIC to the interface. Be sure to observe the proper orientation of the connector when plugging into the computer. Otherwise, the fuse will blow inside the VIC and your heart will stop. I used a larger connector from Radio Shack and cut it down with a hacksaw. Before using it, though, take a piece of nonconducting perfboard cut to the same length as the back of the connector. Slide it between the two rows of pins on the back of the connector (see Fig. 2) and epoxy with nonmetallic epoxy. The five-minute kind seems to be okay. Be sure not to cover the pins needed to solder for the connections. This will make it easy to plug and unplug the connector from the computer.

These programs have been running for several months now with no problems. I hope that even if you don't now have a computer, these program descriptions will make it easy for you to get on RTTY and ASCII when you do get a computer. If you have any questions or problems, write me and enclose an SASE to expedite a reply. I will try to help if any problems arise. If you don't feel like typing these programs, send five dollars for a cassette or ten dollars for a disk to cover the cost of copying and postage. The disks are formatted for DOS2.6 on a 1540 single-disk drive. Send to Richard Hudgins, Rt. 1, Box 1254, Kountze TX 77625.

I would like to thank my wife for her patience and typing skills and Hulin Smith WB5UOI for his suggestions and hours of sometimes fruitless on-air trials. I'll look for you on RTTY. There's a whole new world waiting for you there. ■

John H. Phelps W2GEF
3940 Hancock St., Suite 211
San Diego CA 92110

Satellite Supremacy

Sometimes 15 Watts just doesn't cut it with OSCAR 10. The solution? Use W2GEF's 60-Watt uplink amp—stripline construction makes building it a snap!

Many hams who have followed the home-built transverter route for OSCAR 10 have wound up in the 10–25-Watt output range and feel a little under-powered. You can build an effective, low-cost amplifier to get a good solid signal into the satellite without feeling guilty about robbing transponder power from the other guy. With 60 Watts and a net gain of 10 dB (antenna gain less feedline loss), the effective radiated power will be 600 Watts. This level will result in a received signal which is about the same strength as the 145.810-MHz beacon.

Design

The amplifier uses a Motorola Semiconductor MRF-648 rf power transistor characterized as a 60-Watt device (power output) at 470 MHz. This power level is reached, typically, with an input of 19 Watts and a 12.5-volt collector supply voltage. Power gain is slightly higher at 13.6 volts.

Design of the amplifier began with an examination of the MRF-648 test circuit in the *Motorola R.F. Data Manual*. This circuit closely resembles the designs of several commercial units and was considered a pretty safe way to do the job. Unfortunately, it uses rather expensive and hard-to-get capacitors and has four tuning adjustments.

In the interest of low cost, ease of construction, and simple adjustment, an amplifier was designed using an approach which features a single input- and a single output-tuning adjustment and a minimum number of fixed capacitors. Low-power linearity is improved by a simple bias circuit which stabilizes against thermal runaway and idles the amplifier at 150 mA collector current.

The MRF-648, at a power output of 60 Watts and a collector supply voltage of 12.5 volts, has a series-equivalent input impedance of 0.82 + j3.3 Ohms and requires a series-equivalent load impedance of 1.07 + j2.7 Ohms (this is the conjugate of the load impedance into which the device operates). So input and output matching networks are required to perform a transformation from a 50-Ohm resistive source and load (the amplifier's input and output impedance) to these impedances.

One way of doing this is to use quarter-wave transmission lines with variable capacitors in series to cancel the inductive components of the input and output impedances. This requires input and output transmission-line characteristic impedances in the six-to-seven-Ohm region. These lines are too wide to fit the base and collector tabs of the transistor without removing material to avoid shorts and also results in high currents in the variable capacitors. A better scheme is to represent the input and output impedances by their parallel-equivalent values, then cancel the reactances with an appropriate parallel variable capacitor. Line widths fit the transistors nicely, capacitor currents are reduced, and layout is considerably simplified.

The input circuit consists of a quarter-wave transmission-line transformer which transforms the 50-Ohm input to match the low (.81-Ohm series-equivalent) value of the real part of the transistor input impedance. The parallel equivalent of the input resistance is 13.9 Ohms, so a transmission line Z_0 of about 26 Ohms is needed, and a parallel capacity of about 100 pF cancels the equivalent parallel inductive reactance of the transistor input impedance. A similar scheme in the output calls for a shunt-tuning capacitor of about 120 pF and a quarter-wave transmission line of 19 Ohms. The dimensions, using glass-epoxy board, are reasonable (3.4-inch length for the input line and output lines). Dielectric losses are small at the low impedances involved and no attempt was made to use more expensive, hard-to-get materials.

The input- and output-tuning capacitors are garden

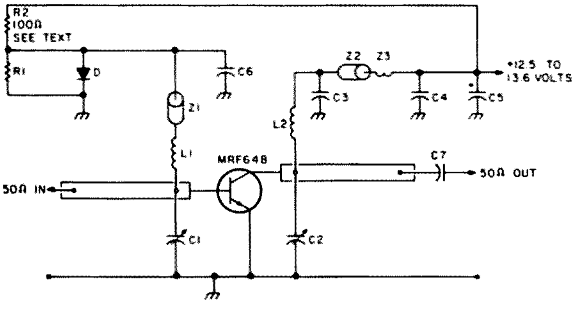


Fig. 1. Schematic.

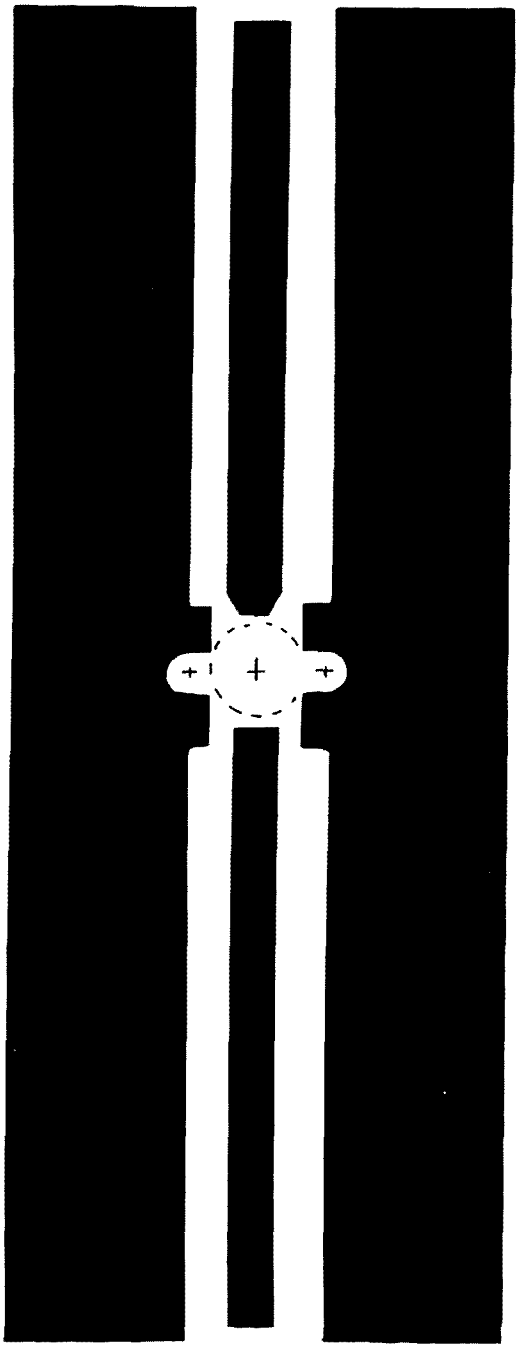


Fig. 2. PC-board pattern.

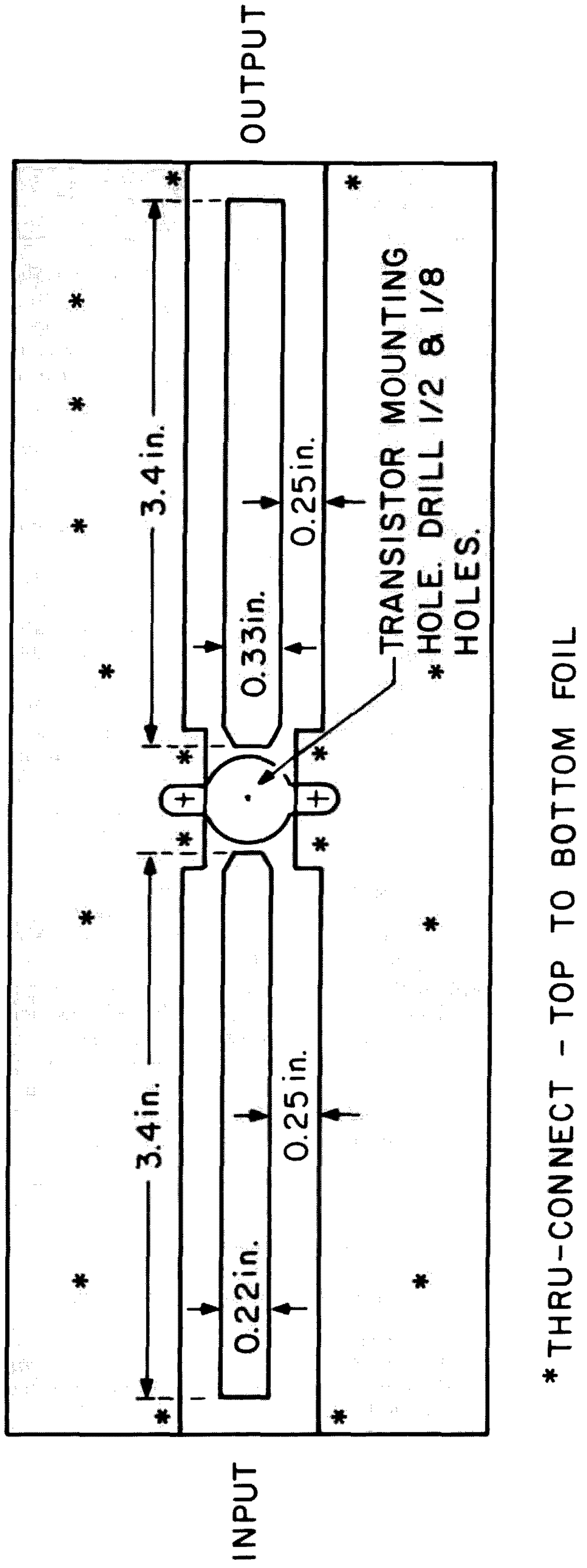


Fig. 3. Board dimensions.

variety Arco mica compression trimmers which handle the required current without any problem.

Construction

Since the board layout consists of a few straight lines, I used tape as a resist and cut and peeled the areas to be etched.

Next, the body of the MRF-648 must be recessed into the board to make connection to the PC board. A center mark for drilling a half-inch hole should be placed midway between the inner ends of the input and output transmission lines and on the transmission line center lines. Next, 1/8" hole centers, 0.73" apart, are drilled above and below the center of the half-inch hole and the board webs are filed away to allow the transistor to pass through the board. The top and bottom ground foils are connected together by soldering #18 bare copper wire or brass rivets

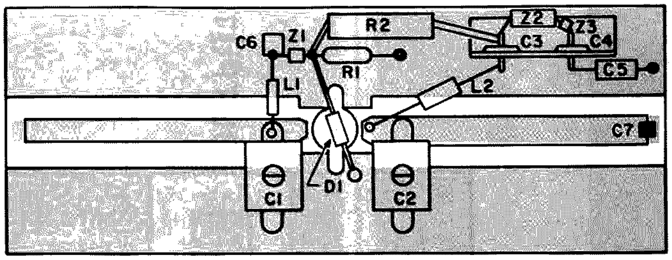


Fig. 4. Parts placement.

through the board to top and bottom foils at the indicated locations. They are essential to proper operation.

Now add the transistor, the Arco capacitors, and the remaining components in that order. Use care to ensure that there are no shorts from the collector and base tabs to the emitter tabs through the transmission lines at the points where the lines are beveled. Also, make sure that the narrow transistor tab (the collector) is soldered to the output (widest) line. A little carelessness here cost me a transistor.

The inductors, L_1 and L_2, are close wound on a #39 drill; C_3 and C_4 are mounted on an L bracket with holes drilled to clear the center feedthrough terminal of the button capacitors. Other feedthrough types can be used. This type of capacitor provides a convenient mount for Z_2 and Z_3. At any rate, both C_2 and C_3 must be low-inductance capacitors.

The bias diode, D1, lies on the face of the transistor top and is coated with heat-sink compound and pressed down for close physical and thermal contact with the transistor.

The bias resistor, R_2, has a value of about 100 Ohms, but its best value depends on the particular combination of transistor and diode assembled. The power dissipated in the resistor is about 2 Watts. Four or five 1-Watt, 470-Ohm resistors paralleled will result in 94 or 117 Ohms and will dissipate 4 to 5 Watts safely. Resistors can be added or deleted until an idling current of 150 milliamperes results.

The output blocking capacitor must pass about one Ampere rms at full power and have low inductance so that there will be adequate range in the output-tuning capacitor to achieve output match. Capacitors in the range of 100 to 1000 picofarads are acceptable and can be a solderable disc (no leads) or chip (ATC) capacitor. If a mica trimmer is used, keep leads short and watch out for heating.

I used BNC connectors at the input and output with brass shim stock mounts soldered to the lower foil. (Note the through-connects at input and output.)

Heat-sinking for the amplifier is a matter of serious concern since about 60 Watts of heat must be disposed of without causing the transistor to exceed its short-term and long-term upper temperature limits. First, choose a black anodized (or black air-drying-enamel sprayed finish) heat sink; it will require about one-fifth the surface area of bright (polished) aluminum. Surface area is of prime importance so try to find a finned sink. The fins should be on one surface only so that the board and transistor can mount on a flat unobstructed side. The aluminum thickness is important and should be at least 1/8". Air flow along the fin grooves should be ensured. The sink I used is 1/4" thick at the transistor, has fin grooves along the long (9") dimension, and is 6" wide. The grooves (fins) are 2" deep. Don't be afraid to use an oversize sink. If you must go undersize, use forced air.

Filled heat-sink compound provides the best thermal conductivity between the transistor and sink, but make sure air bubbles are excluded by pressing and rotating the transistor as it is mounted.

Tune-Up and Operation

Before connecting the amplifier to a source of drive power, make sure that the driver has a series blocking capacitor. In the rare cases where there is no dc blocking capacitor, one will have to be added.

A 50-Ohm dummy load should be connected to the output connector. Most dummy loads available to amateurs are not purely resistive and some are not usable at 70 cm. The new Heath "Cantenna" advertises an swr of less than 1.5:1 at 450 MHz. A lightly coupled diode probe can be used to indicate relative power.

If you have a VHF directional coupler, use it for a relative power indicator.

Apply about 10 Watts of drive and peak the input trimmer for maximum power, reduce drive to cut the indicated power reading by about half, and tune the output trimmer for maximum. Further reduce the drive and re-peak the input. Touch up the output at full drive and you are ready to connect to the antenna. For maximum stability and safest operation of this amplifier, the antenna and feedline combination should present a load close to 50 Ohms resistive, which means an swr close to 1. Make antenna adjustments at reduced power and operate with an swr of less than 1.5. ■

Parts List

C1-2	16-150-pF Arco mica trimmer	CS #424
C3-4,		
C7	1000-pF low-inductance button, mica, or chip	KCS #21CC510
C6	500-pF chip	KCS #21CR650
C5	1-uF tantalum	
L1	10 turns #26 AWG on 0.1" inner diameter form, close wound	
L2	10 turns #20 AWG on 0.1" inner diameter form, close wound	
Z1, Z2	Small ferrite bead	KCS #FB43-226 DP
Z3	Large ferrite bead	KCS #FB43-287 DP
R1	7.5 Ohms, 1/2 Watt	
R2	Selected—see text	
D1	1N4001	
	MRF-648 power transistor.	R.F. Parts Co.
	Glass-epoxy board material—dielectric approximately .050" thick—double-clad copper	

CS—Circuit Specialists	KCS Electronics Corp.	R.F. Parts Co.
PO Box 3047	1043 N. Stadem Dr.	1320 Grand
Scottsdale AZ 85257	Tempe AZ 85281	San Marcos CA 92069

James L. Patterson DA1CY/KB5LF
PO Box 123
APO NY 09130

CB to Six

Why stop at 10 meters? KB5LF's Hy-Gain conversion will take you to VHF just as easily.

Several years of converting CB sets to ten meters makes one really appreciate the built-in ability of these little rigs. Those of us who are operating them now on single sideband or FM can attest to their stability, sensitivity, and clean output. It was for these reasons I began experimenting with the possibility of converting a CB to six meters. Since I had several Hy-Gain boards on hand, that's what I selected for conversion.

My basic criteria for a successful conversion were:

a) Simplicity—The conversion should be no more difficult than to ten meters.

b) Quality—The receiver should maintain its original sensitivity/selectivity; additionally, the transmitter output should be very clean!

c) Cost—I firmly believe a conversion loses its appeal when the price is too high or when exotic parts are used and can't be easily obtained.

After the conversion was completed, I felt that the criteria had been met. The little rig operates beautifully on six meters!

My objectives in writing this article include:

a) Offering specific information to convert the Hy-Gain board to six meters.

b) Giving enough general information to allow you to begin converting the CB of your choice.

c) Increasing the use of our six-meter band.

I must tell you in the beginning that I will not describe the hookups required to make the board operate nor specifically detail FMing the rig. I'll just refer you now to the many excellent *73* articles that have detailed this part of the conversion. Your main obstacle to six-meter operation is moving the radio from eleven meters AM to six meters AM. Sidebanders, take note—I'll not forget you, either. Your conversion may also be surprisingly simple.

Examine the basic block diagram of Fig. 1. To move any CB in frequency, the master frequency source (vco, crystal synthesizer) *must* be made to operate at a new frequency. We know from our ten-meter conversions that we must increase the frequency. The question is, how much? Keep in mind that, generally speaking, the master frequency source (vco, synthesizer) of most CBs does not change frequency between transmit and receive. If we can determine the correct vco frequency to inject into the first receive mixer, we will also have found that this same frequency is used for transmit.

Refer again to Fig. 1. Three incoming frequencies are shown. The first is an incoming original CB frequency; the second is a 10-meter FM frequency; the third is a new frequency in the six-meter band. Note also that these frequencies are in the center of their respective bands. The frequencies generated by our master frequency source that mixes with the incoming signals is also shown. Let's examine how the master frequency is determined.

If we examine Fig. 1, we see that a 27.185-MHz signal is amplified by one or more rf stages before it is mixed with the master frequency. During the mixing process, the first i-f frequency is selected. In our case, the first i-f frequency is 10.695 MHz. In almost every case, the receive-mixer circuitry selects the *difference* frequency. Our equation:

For 11-meter operation—master frequency = incoming frequency + first i-f frequency = 27.185 MHz + 10.695 MHz = 37.880 MHz.

For 10-meter operation—master frequency = 29,600 MHz + 10.695 MHz = 40.295 MHz.

For 6-meter operation—master frequency = 52.525 MHz + 10.695 MHz = 63.220 MHz.

The equation in a different form: master frequency − incoming frequency = first i-f frequency.

If your particular radio

uses a different i-f frequency (10.7 MHz, 7.8 MHz, etc.), change the i-f frequency in the formula and crank out the new master frequency. During the change to 10 FM, the Hy-Gain's vco frequency was increased about 2.5 MHz, an increase of approximately 6%. This change is not excessive. There is enough adjustment range in the circuitry to handle this increase in frequency. Examining the percent change from 11 to 6 meters, we find that increasing the vco frequency from 37.880 MHz to 63.220 MHz involves increasing the frequency approximately 25 MHz. The percent change in frequency is approximately 67%. This is asking too much of the circuitry. Without major modification to the vco circuitry, it will not operate in the 60-MHz region.

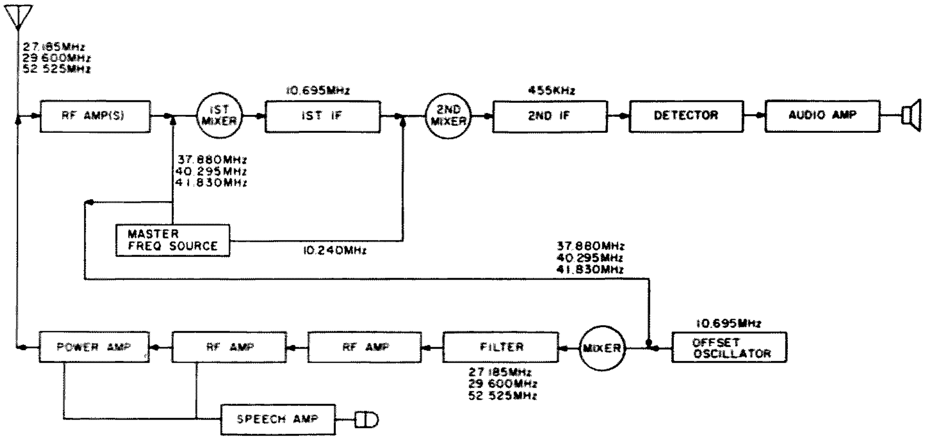


Fig. 1. Hy-Gain CB block diagram.

Any time two frequencies are injected into a mixer, many different frequencies are produced in the output. Of special importance are the sum and the difference frequencies. The tuned portion of the mixer's output will determine which of these two frequencies is emphasized. As an example, using Fig. 1, 27.185 MHz and 37.880 MHz are injected into the first mixer. The sum of these two frequencies is 65.065 MHz. The difference is 10.695 MHz, the frequency of interest. In our case, the mixer selects the difference frequency. The reader may verify the frequencies used for 10-meter operation. Note that in both 10- and 11-meter operation, the master frequency is higher than the incoming frequency; hence the term *high-side injection*.

There is another frequency that will mix with the 37.880-MHz signal to produce the 10.695-MHz output. In this case, a 48.575-MHz signal mixed with the 37.880-MHz signal will also produce the required 10.695-MHz i-f output. This frequency is called the *image frequency* and will be detected if allowed to enter the mixer. Fortunately, the designers incorporated the proper circuitry beginning at the antenna input and in the rf amplifier stage(s) to reject the image frequency. If you desire, you can determine that the image frequency on 10 meters falls within the 6-meter band.

The problem I had to solve was on what frequency must the master frequency source operate to receive a 52.525-MHz signal and produce a 10.695-MHz output. I rejected using the 63.220-MHz frequency as described above. I elected to run the master at 41.830 MHz. Again, the difference frequency (52.525 MHz − 41.830 MHz) gives us the required output from the mixer. This mixing scheme is called *low-side injection* because the frequency of the master is lower than the incoming frequency. Using 41.830 MHz as the master frequency will allow the receiver to also detect a 31.135-MHz signal (the image frequency) if our tuned circuitry at the input will allow it to pass. We will cure any image frequency interference in this conversion.

The modification to 6 meters of the Hy-Gain vco is exactly like that required for 10-meter operation (refer to Fig. 2). Only the 11.8066-MHz crystal need be changed and the vco retuned to operate properly in the 42-MHz range. I'll briefly describe its operation and then recommend a replacement for the original crystal.

The 10.240-MHz oscillator is fed into pin 3 of the PLL02A chip. It is internally divided by 1024 to give us a reference frequency of 10 kHz. This means that our channel spacing will also be 10 kHz. Notice also that the 10.240-MHz signal is sent to the receiver section and mixed with the 10.695-MHz i-f, resulting in a second i-f frequency of 455 kHz (10.695 − 10.240 = 455 kHz).

The vco frequency of 37.660 MHz (CB channel 1) is fed to both the receiver and transmitter sections of the radio. Since we are dealing with a PLL circuit, this frequency must be fed back to the PLL02A chip and compared with the reference frequency (10 kHz) to see if any change in frequency is needed. Since the PLL02A has an upper limit (at pin 2) of approximately 3 MHz, some method of mixing the signal down to less than 3 MHz is needed. This is the reason why the 11.8066-MHz oscillator/tripler is in the circuit.

In Fig. 2 we see the 11.8066-MHz frequency being tripled to 35.4198 MHz. The tripling occurs within the circuitry associated with Q105. This frequency is mixed with the 37.660-MHz signal from the vco, and the difference frequency of 2.24 MHz is selected by the use of the low-pass filter (C108, L101, etc.). A mixer buffer (Q103) follows to ensure that the PLL02A does not load the circuitry and gives additional gain to the 2.24-MHz signal.

Assuming the vco is operating exactly on 37.660 MHz, a signal of 2.24 MHz will appear on pin 2 of the PLL02A. If the programming pins (7 through 15) on the PLL02A are set to divide by 224, a 10-kHz signal (2.24 MHz ÷ 224 = .010 MHz) will be generated. This is exactly the same frequency as the reference. The system is said to be "phase-locked." If the vco tries to change frequency or programming to the PLL02A changes, the frequencies generated internal to pins 2 and 3 will no longer be identical. The PLL02A senses this and changes its output voltage across the varactor diode (D101) to steer the vco to a condition where again both signals internal to pins 2 and 3 are 10 kHz. For you that experiment, I have found that by changing crystals and retuning the vco coil (T101), I could lock the loop from about 28 to 48 MHz. Not bad for this little circuit!

I wanted the mid-band frequency to be 52.525 MHz, one of the simplex calling frequencies for 6 meters. I knew the vco would probably be capable of maintaining lock over a

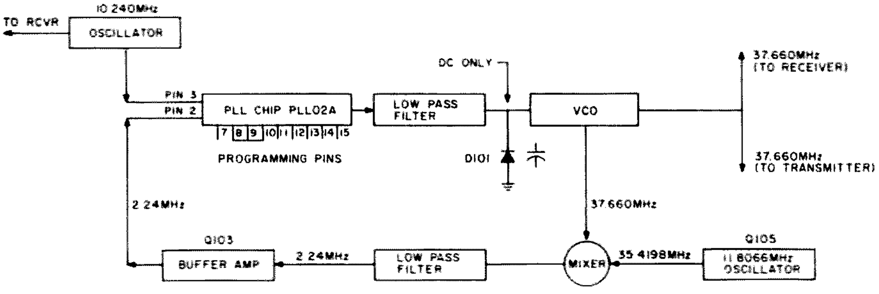


Fig. 2. Hy-Gain PLL circuit (CB channel 1).

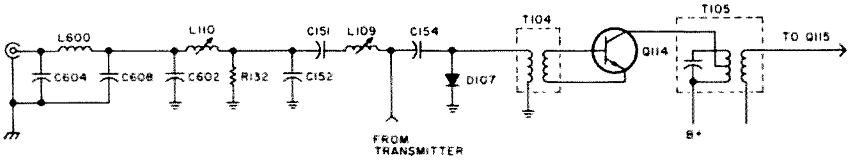


Fig. 3. Hy-Gain receiver front end.

540-kHz range. Therefore, I subtracted 270 kHz from 52.525 MHz to give a channel 1 frequency of 52.255 MHz (PLL02A set to divide by 224). The high end frequency would be at least 52.795 MHz.

If channel 1 was to be 52.255 MHz, my only problem was to decide what crystal frequency was necessary such that when it is first tripled and then subtracted from the vco frequency, the difference would be 2.24 MHz. Using our low-side-injection scheme, 52.255 MHz minus the vco frequency should equal the 10.695 i-f frequency. With scratch paper handy, a quick calculation gives us a channel one vco frequency of 41.560 MHz. If we now subtract 2.24 MHz from 41.560 MHz, we will have the oscillator frequency in tripled form. This subtraction yields 39.320 MHz. Dividing this by 3 yields the correct oscillator frequency of 13.1066 MHz. If you use another division scheme or elect to cover a different portion of the band, all numbers must change accordingly. Any of the crystal manufacturers can supply you with the correct crystal if you specify the make/model of CB and the old/new crystal frequencies.

When the new crystal (13.1066 MHz) arrives, install it in place of the 11.8066 crystal and begin the vco alignment. Access to a frequency counter and a good oscilloscope are required for proper alignment. I won't detail the vco alignment procedure as this is covered in the *Photofact* and in many of the articles appearing in *73*. A few words of caution may prevent problems:

a) All oscillators must be on frequency.

b) On some of the boards there are two positions of the vco coil slug that will give you a 1.5-volt reading. Only one is correct. If you've selected the wrong one, the vco will not track as the channels are advanced. Other radios may exhibit this same problem.

c) Ensure that the vco does not change frequency when the transmitter is keyed.

d) Ensure that T111 is set for maximum. Much of the performance depends on it.

One last word on PLL circuits may aid those of you who will convert a different radio. If you follow the low-side-injection scheme, you will keep the vco operating near the original design frequency. This greatly simplifies the conversion!

Receiver Conversion

Once again referring to Fig. 1, it is seen that once the signal passes the first mixer, we are into the i-f frequencies. I might as well tell you now that no modifications are required beyond the input to the first mixer! In simple language, once the desired signal is into the first i-f stage, the radio couldn't tell you if the original incoming frequency were 27 MHz or the new 52-MHz signal.

Fig. 3 shows the Hy-Gain input circuitry from the antenna through the first and only rf amplifier stage (minus a few parts). If you are converting a different CB, it will probably surprise you to find your input circuitry very similar to the one shown. Disregard for now all the components from the antenna connector through L109. We will work with these later. Our concern will be with C154 and the coil which is the primary of transformer T104. A grid-dip meter will verify that this combination is resonant in the 11-meter band. There is enough tuning range in the primary coil to tune 10 meters, but not enough to tune 6 meters. Changing C154 from 27 pF to 10 pF will let this combination resonate in the 52-MHz region.

Fig. 3 also indicates a tuned-collector output which is coupled into the base of Q115, the first receive mixer. Since the capacitor is inside the can, T105 must be removed and the capacitor leads clipped. There is no need to remove the capacitor from its seat inside the can. Just be sure that the leads are trimmed so they do not touch anything. Be careful unsoldering the can or you may damage the foil trace. This is good practice as this same bit of surgery will be required a time or two in the transmitter section. Install an 18-pF capacitor across the primary terminals on the foil side of the board.

A basic tune-up can now be accomplished using the receiver alignment instructions supplied in the *Photofact*. Don't expect the receiver to be extremely sensitive, as we have not yet corrected the majority of the input circuit. You will get enough signal through to satisfy yourself that the receiver is now on 6 meters. Don't forget to use a midband frequency for the alignment.

The receiver conversion for a different radio will closely parallel this discussion. A few tips may save you some time and effort:

a) Performance-test the CB prior to conversion. Record signal levels. Be sure these levels exist after the conversion.

b) You will have to grid-dip the transformers to find the correct value of capacitance for resonance.

c) Examine the general specifications for the transistors in the front end of the receiver (Q114 and Q115 were questioned in this case). Hy-Gain used two transistors which have a large bandwidth (F_t) and high current gain (h_{fe}). If you will look these up in a transistor manual, you will see what I mean. Examining several CB schematics did not

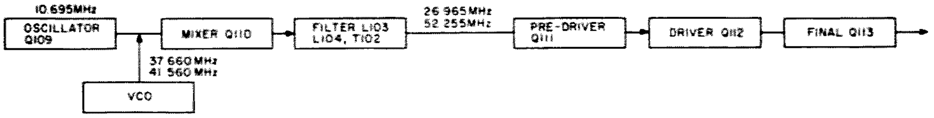


Fig. 4. Hy-Gain transmitter block diagram.

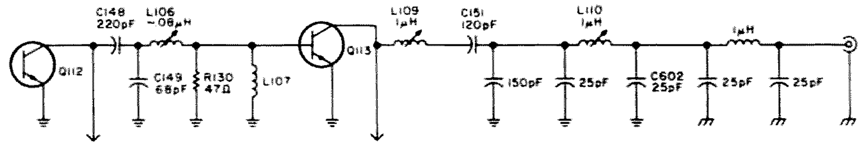


Fig. 5. New driver/final circuitry (simplified).

reveal a problem here, but it's worth checking.

d) Any time you modify the capacitor values in a tuned circuit to change the resonant frequency, the value of capacitance found is only approximate. You may need to change the value slightly in the actual circuit. This is due to the dynamic loading effect when a circuit is in operation.

Transmitter Conversion

Fig. 4 shows a block diagram of the Hy-Gain transmitter section. Also shown are the vco frequencies for both an original CB frequency and a new 6-meter frequency. Since the vco is already on frequency, all that remains is to modify the circuitry following the mixer. In the case of the CB frequency generated (26.965 MHz), the filter (L103, L104, and T102) selects the *difference* frequency (37.660 − 10.695 = 26.965 MHz). After conversion, L103, L104, and T102 will select the *sum* frequency (41.560 + 10.695 = 52.255 MHz).

Remove L103, L104, and T102 one at a time. Remember which one goes where so there is no confusion when they are reinstalled. The following steps will allow these cans to select the sum frequency:

a) Remove C124 (100 pF). Remove the small capacitor internal to L103. Reinstall L103 and solder a 33-pF capacitor across the same pins the original capacitor was across, on the bottom (foil side) of the board. Be sure to keep the capacitor leads very short. On this can you may simply place the 33-pF capacitor in the C124 location.

b) Perform step 1 to L104. Install a 15-pF capacitor across the proper terminals on the foil side of the board.

c) Perform step 1 to T102. Install a 15-pF capacitor as in steps 1 and 2.

d) Remove C141 (68 pF). Replace C141 with a 39-pF capacitor. This is required to enhance the impedance match into the base of Q111. Grid-dipping the secondary of T102 shows the secondary resonant in the 55-MHz region (with the 68-pF cap).

Next remove T103. If you glance at the schematic, you might wonder why. It would appear that since resonating capacitor C143 (100 pF) is external to the can, one might just remove it and install a 25-pF cap in its place. This will resonate the can in the 52-MHz region; however, the transformer turns ratio is now wrong. Examining the primary and secondary windings of T103 revealed a 6-turn primary and a 1-turn secondary. I could have rewound T103, but I had no wire that small. I used a ¼-inch coil form using an 8-turn primary and a 2-turn secondary. Grid-dip the primary to find the amount of capacitance needed to resonate at 52.5 MHz in the middle of the coils tuning range.

C146 (470 pF) is removed next. This enhances the impedance match at the base of Q112. Now we are ready to modify the driver and final circuitry.

Perform the following steps:

a) Remove R203 (560-Ohm resistor).

b) Remove C149 (220 pF).

c) Remove L106.

d) Remove C153 (82 pF).

e) Install a 68 pF capacitor in place of C149 that you have just removed.

f) Examine L106. We must lower its inductance by removing 2 turns. It looks factory formed, and it is. Locate the low side of the coil. Using a sharp carpet knife or similar instrument, you can cut the wire leg loose. The wire can then be unwound. Remove 2 turns and form a new leg for the coil. As a guide, the reactance of the coil should be 25 Ohms at 52.5 MHz.

g) Remove C151 (100 pF) and install a 220-pF cap in its place.

h) Remove L109. Remove enough turns to give 33 Ohms of reactance at 52.5 MHz. Its inductance should be .1 uH.

i) Remove R132 (47k Ohms) and C152. Replace C152 with a 150-pF cap. Replace R132 with a 22-pF cap.

j) Remove L110. Remove 2 turns. It should now have .1 uH inductance. Reinstall L110.

k) Remove C602 on the foil side of the board (if installed). It's attached between board ground and the antenna side of L110. Replace it with a 25-pF cap.

l) Additional filtering is needed to doubly ensure a clean output. A pi-filter will now be installed going from point 5A on the circuit board to the antenna terminal. Install an airwound coil similar in size to L116 between the board's output (5A) and the center of the antenna connector. I used an extra L116 off a broken Hy-Gain board and removed all but 3 turns. If you fabricate your own coil, the inductance should still be .1 uH. Install two 25-pF caps. One should be installed from the center of the antenna connector to chassis ground. The second cap should be installed from either point 5A or 5B to chassis ground.

m) We are now almost finished. Remove Q112 and replace it with Q113. Obtain a 2SC1307 transistor to use in the final. The original Q112 (2SC1760) does not have enough gain in the 50-MHz range. If you are converting a different CB, be sure to check the performance of the transistors. After completing the above steps, your circuit should look like Fig. 5. Notice I did not show R129, L105, L116, L108, etc. These remain unchanged!

You can now perform the alignment of the transmitter using the steps listed in the *Photofact*. As other authors have said, the alignment of L103, L104, and T102 is *critical!*

By using single-pole, single-throw switches to program pins 1 through 15 of the PLL02A, you can expect at least 1-MHz band coverage. My conversion gave me about 1.1 MHz, but the recommended voltages were not followed at the edges of the band. The vco, however, remained very stable over a voltage range of .9 to 4.5 volts. Average transmitter output averaged 3 Watts across the band, and its output is very clean.

The standard FM techniques can now be applied

exactly like the conversions to 10 meters.

Several improvements can be added to enhance the capability of your conversion:

a) The standard bells and whistles that have been used with the 10-meter conversions (Delta-tune, scan, frequency programming, wide audio filter, etc.).

b) Repeater offset may deserve some special mention. I have discovered that by switching transmit offset crystals, I could achieve up to 400-kHz offset without problems. If you elect to install the offset, please note that a 400-kHz split is not possible across the entire band. If you exceed the frequency limits on transmit or receive, the vco will lose lock.

I think you will find that many other used CBs operate using this same scheme. Many are practically identical! I hope this article heats up some soldering irons and sharpens a few pencils. I am sure the circuitry presented here can be improved.

For those of you interested in converting an SSB CB, I recommend staying away from those radios whose vco operates in the 19-MHz range. They can be modified, but the conversion is much more difficult. Select one that operates in the 38-MHz range and utilizes a fairly high first i-f. If you do this, you can be reasonably sure it will convert. As a bonus, the SSB generating circuitry prior to the transmit mixer will require no modification.

Completing this project confirmed my belief that 50 MHz is possible from a CB. I will be happy to answer any questions concerning this conversion if you will send an SASE. I'll send my recommendations on any other CB conversion to 6 meters if you will send me a copy of the schematic. Let's use our six-meter band! ■

Cortland E. Richmond KA5S/1
54A Elm Street
North Andover MA 01845

Future Schlock

The strange tale of the KA5S experiment. Was he a genius or a madman?

Part I: The Genesis of an Idea—

When I first started my experiments, I had no idea they would lead me to such arcane conclusions. Like many others, I was just curious. And, in true amateur spirit, I was determined to breadboard my way to knowledge. I could not know I would be answering the question of the Long Delayed Echo or discovering what happened to the missing OSCARs!

I began by asking why LHCP (Left-Hand Circular Polarity) signals could not be received by an RHCP antenna. The antennas are all but identical, after all; the vertical and horizontal elements line up exactly. And so my first experiment was to find out just why the radiated wave is not received.

I started by setting up two linearly-polarized, 2-meter antennas (3-element beams), one vertical, one horizontal, 3 meters apart. From my work in the EMI lab I knew this was a good distance. It also gave 1 meter per element, which might simplify the subsequent mathematics.

With 300 milliwatts from my HT, I was able to adjust the antennas so that if I transmitted with one, no signal would be received by the other. This was exactly what theory said would happen!

In order to make sure that there was nothing untoward going on, I checked the area between the two antennas with a simple diode field-strength meter, using an untuned loop antenna .05 wavelengths in circumference. There was indeed a strong rf field being transmitted. As a further check, I ran equal lengths of coax to each antenna, feeding them both from the HT. There was still a strong signal in the space between them. Again, all was as expected.

I next added three more elements to each antenna at right angles to the ones already mounted, creating two miniature, circularly-polarized beams. I was careful to arrange the phasing so that one was right-hand polarized, while the other was left-handed. Then I repeated the above experiment. No signal was received, just as I had been informed. The surprise came when I again checked the area with my FS meter. Sending with both antennas, I discovered the signal *disappeared* midway between them! Something *really* strange was happening!

It was obvious I had discovered a hitherto unknown phenomenon: Cross-polarized antennas create a dead space between them into which radio waves disappear. The question was: Where do they go?

Part II: Investigations and Fulminations—

This line of experimentation had reached a dead end. There was no way I could pursue the missing rf energy. I did not even know where it was!

Some deep thought was in order, and I resorted to a "thought experiment." (This requires no equipment, and you can arrange antennas anywhere you like.)

In thinking over the parameters of my dilemma, I recollected that I had created a situation in which every possible field orientation had been represented. Could it be that the resultant field possessed an orientation which was 90 degrees out of phase with *all* of these? In other words, had I created a signal which was oriented at right angles to all three spatial dimensions? This would explain my inability to detect it; I was limited by the physical structures possible. And by following this logic, I could explain where the signal would show up again!

The orientation that is at a right angle to the three spatial dimensions has been called the "fourth dimension." It is also known as TIME. The signals had been translated to a different time! If I arranged to measure field strength when the rf arrived, I would be able to confirm this. But I still faced a problem. Did the signals arrive before or after I sent them, and how much time separated the transmission and the reception?

Resolving this question turned out to be easier than I had expected. It was necessary only to set up the field-strength meter, without transmitting, and wait for the signal. I would transmit

short (2 second) pulses every hour, and see when the signals showed up.

The idea seemed right, so I began an exhaustive (and exhausting) routine. For 57 hours I followed my routine, sending a pulse ever hour, and watching the field-strength meter the rest of the time. Because of the time involved, I did not dare take my eyes from the meter.

To stay awake, I ate half a jar of instant coffee. (I had discovered the effectiveness of this during Field Day.) By not mixing it with water, I avoided having to relieve myself. I left three bowls of cat food out, warned my son not to disturb me for three days, and commenced.

Success seemed mine very early in the experiment. Signals were appearing even though I was not transmitting. Unfortunately, I could not be sure that they were a result of my transmissions. I stuck with it. It was 42 hours into the procedure when I was almost sure I had identified the time interval, and by the 55-hour point I was sure. At the 57-hour point, I fell off the chair.

It was necessary to suspend investigations for two days while I slept. A thorough statistical analysis could follow.

Part III: Click, click, buzz, whirr—Eureka!

With the data in hand, it became necessary to break out the calculator. I was trying to find some correlation between my transmitted signals and the ones I had received. I had three sets of data: the time and frequency of the received signals, and the transmitted signal time. A scanner had provided me with the frequency, while the FS meter made sure it was strong enough to be *my* signal.

I had 27 strong, received signals. I had been sending on a clear frequency, 146.505 MHz. The received signals were clustered around 146.520 MHz. No doubt they had gained energy by being translated in time. (I made a note to myself to remember to patent this kind of linear translator.) By analysis, I found the received signals were clustered around 2, 3, and 7 minutes before and after my pulsed transmissions, and at multiples of these intervals.

The frequency distribution showed a 3-Sigma distribution skewed upwards from my transmitter, but was well within possible changes due to time differences. Since there was a positive statistical correlation of .56 for the time intervals I mentioned, I was able to conclude that my theory was correct, and that I could look for return signals both before and after sending them. I resolved to concentrate on the latter case, since it was difficult to tell if a given signal was mine before I sent it.

Part IV: The Future (Long May It Wave)

As a result of these experiments I am working on a less cumbersome apparatus than two antennas which will allow me to send signals into the past as well as into the future. By modifying the active principle, I expect to be able soon to build a time-variable receiver as well. This will mean I can work all the DXpeditions even though I missed them before. And I won't have to wait for an answer, either, since I will be able to adjust the time mixer for the exact time at which the DX station answered (will answer) me.

The main factor now standing in my way is the fear that I will be deluged by a whole lifetime of DX QSOs all at once, and won't be able to make any of them out! Can anyone help me? ■

✓ *See List of Advertisers on page 80*

Robert E. Bloom W6YUY
8622 Rubio Avenue
Sepulveda CA 91343

Swr: A Modern Myth?

From rig to radials, noted expert W6YUY reveals the path to a perfect antenna system. Be ready for a few surprises.

If you want to know why your signal doesn't get out any better than it does and you would like to find out how to improve it, perhaps this is the information you need.

There are at least two extremely important areas relating to the construction and operation of an antenna system where there has been either too little or an excess of information. I am referring to antenna ground systems and vswr, respectively. It is my intention to furnish information that will get you thinking in the right perspective so that you can attack the problem sequentially and with a knowledgeable plan of action. This, then, is an article on the fundamental facts relating to how the quarter-wave antenna system functions. All of the fundamentals and design theory were developed and used successfully by the broadcasting industry in the early 1930s; little has changed since.

To understand "antenna performance," there are a few factors one has to accept from the very outset:

(1) The performance of an antenna is an exact science and not a hit or miss proposition.

(2) Performance is designed and not experimented into the antenna system as a whole. This includes the ground system, transmission feed system, and the antenna radiator proper. The efficiency and total performance are exactly predictable even before a signal is ever sent down the line.

(3) The ham is always fighting compromises. They are tied to the environment (surroundings), geographical location, antenna height restrictions, and the placement or location of ground radials.

Much of my explanation will be related to commercial vertical antennas but will apply equally to ham applications. The vertical has been selected as the subject matter as it is easier to define ground system performance exactly and its relation to radiation impedance. Also, it provides the opportunity to touch on phase-driven arrays. Included will be references to exact design formulas for developing high-frequency beam antennas. So let's start at the very beginning and move on from there.

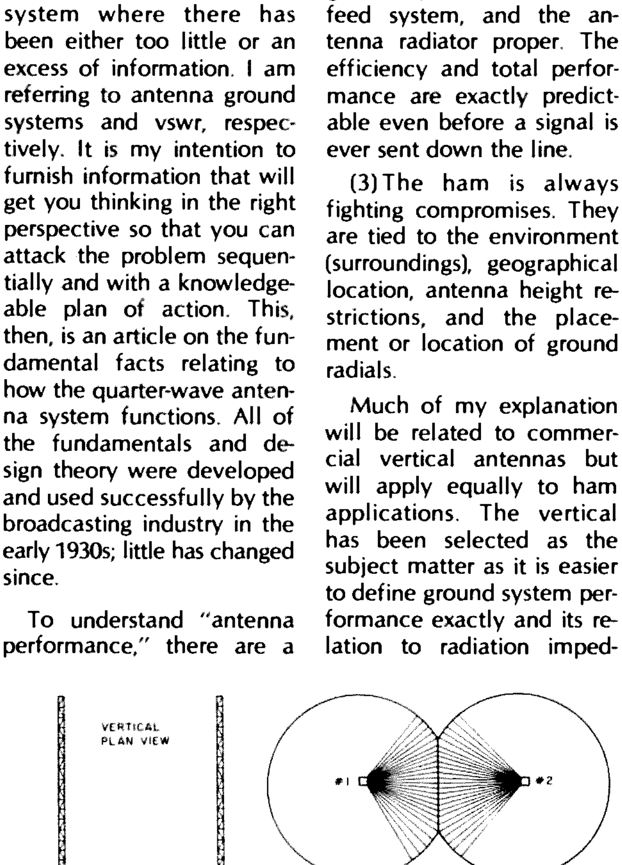


Fig. 1.

The Standard Reference Antenna

One often hears about antenna gain as related to a hypothetical antenna. What is this non-real antenna and why do we have it? As you already know, the National Bureau of Standards maintains such primary references as the volt, Ohm, inch, etc. Everything must be related and have a basic reference so that all the peoples of the world know what others are talking about, so why not a primary antenna?

This isotropic radiator has to be envisioned out in free space, radiating in all directions equally. The field pattern would be shaped like a ball, and the electromagnetic field resulting from a drive of exactly one kilowatt would have a field strength of exactly 107.6 millivolts per meter as measured at a distance of one mile. (The "per meter" indicates that the tuned field-strength instrument used to make the measurement would have a pickup antenna of exactly one meter in length.)

An isotropic antenna as portrayed cannot actually be realized since the free-space requirement is, if not improbable, very impractical. However, this hypothetical antenna has real value as an instrument for determining the figure of merit of all other antennas. The derived field strength is exacting and an antenna's efficiency can thereby be verified. The primary reference standard antenna came into common use for antenna work during WWII.

The Doublet Secondary Standard Reference

A second hypothetical antenna, one with which hams are more familiar, was derived from the spherical primary standard and is known as the doublet or dipole in free space. The secondary standard doublet reference is easier to use when determining figures of merit of ham, broadcast and consumer TV, and beam arrays here on Earth. The dipole in free space consists of a very short conductor (mathematically of infinitesimal length) having a uniform current distribution. This infinitesimal antenna is universally used in developing the radiation properties of antennas of any configuration.

Importance of the Ground Systems

The prime consideration in the design of any antenna

is its ground system, but it is most significant when considering vertical systems. It doesn't make any difference whether they be commercial, ham, fixed, or mobile, the ground system determines not only the efficiency but the directivity. Without a ground system, the antenna feed has no return circuit for the drive current, there would be no counterpoise, no known stable value of radiation impedance, and no dependable direction of the signal. To say the least, the antenna design is a failure before it gets off the ground. Ironic as it seems, there are a good many hams who skim over this part of the construction because the laying out of ground radials appears extremely difficult or out of the question. As a result, one can expect only questionable results and an inefficient radiating device at best.

Construction of Radials

In order for a single vertical antenna radiator to produce an electromagnetic field of energy that is equal in all directions, the ground system will have to have a radial every three degrees. That is 120 radials of at least 1/4 wave in length. Shocking! For a commercial broadcast station this is the minimum required by FCC rules; it also is essential if one expects to control the exact shape of the field pattern. By the use of involved mathematical calculations it is possible to design an antenna system having any desired field pattern. This, however, may require 1, 2, 3, or more additional driven elements set in a straight line or rectangular configuration.

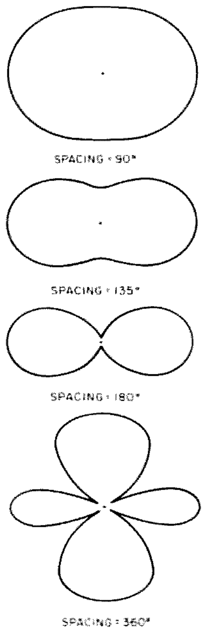


Fig. 2.

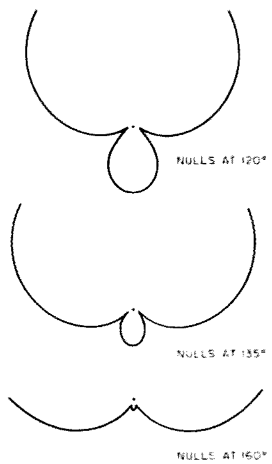


Fig. 3.

Reflections from Parasitic Objects

Commercially, the antenna site selected must be free of metal power poles, water tanks, and smoke stacks or the pattern will have a direction away from the unwanted objects. Metal power poles really can foul up the pattern beyond control. Hams, on the other hand, generally do not have this luxurious option. Fortunately, ham requirements are not this stringent, and if one is reasonably fortunate, there will be as few as three or four ground radials as a compromise. The fewer radials used, the more inefficient the radiated power and the less the directive control. We will pick up this subject again with more detail as we work into it.

Shaping the Field Pattern

Assuming a quarter-wave vertical antenna that radiates a perfect donut-shaped pattern, how does one change the pattern shape? First, a minimum of two or three elements or towers will be required. For the most effective control, all elements should be driven.

There are at least three factors that affect the radiation pattern. (1) The electrical spacing between towers or elements, (2) the amplitude of the drive current to each element, and (3) the phase angle in degrees between the currents in each. Once the number of elements and the spacing between elements have been determined those factors become fixed, and thereafter, the only two remaining variables are the current in each element and the phase angles of these currents. By manipulating these two parameters as mathematically calculated, it is possible to achieve almost any pattern shape desired.

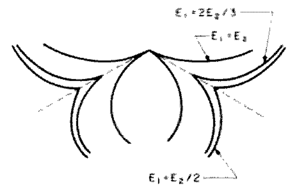


Fig. 4.

Effect of Unsymmetrically-Placed Radials

In a multi-tower system, each with its own ground system, some of the ground radials from one tower could intersect those of the adjacent elements but instead are terminated and bonded together where they meet. (Refer to the illustration of a partial ground system, Fig. 1.) The ground radial systems for each element should be the same. If they are not, some non-circular radiation from a given element or tower could result.

✓ See List of Advertisers on page 80

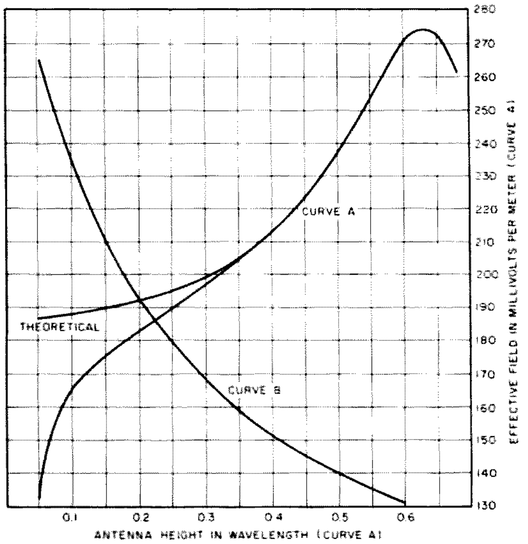


Fig. 5. Effective field at one mile for one kilowatt (curve A). Use for simple omnidirectional vertical antenna with ground system of at least 120 radials, 1/4λ.

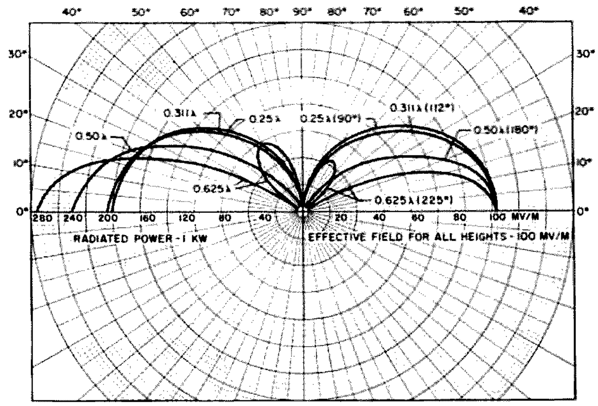


Fig. 6. Vertical radiation patterns for different heights of vertical wire antennas (sinusoidal current distribution).

If, for example, one tower has fewer radials in a given direction than another, the directivity of that tower may be impaired due to the increased ground loss on that side of the tower.

Let's examine one of the most simple systems, one of just two towers or elements. (The terms tower, element, radiator, and antenna are accepted as one and the same.) Bear with me on the concept of 120 radials as it is important. Let's assume that the towers are the same height and each has an FCC-minimum ground system of 120 radials. Additionally, each tower receives the current at the same instant. This means that there is a zero time-phase difference.

Effect of Distance Between Elements Measured in Degrees

Rather than resort to a lengthy explanation, let me refer you to Fig. 2, which has an elliptical pattern resulting from a spacing between elements of a quarter wave, or 90°. Other illustrations in Fig. 2 are for three-eighths wave, or 135°, a half wave, or 180°, and a full wave, or 360° spacing. Note the change in field pattern effected just by changing the distance between driven elements. By fixing the spacing to, say, one-quarter wavelength (90°) and varying the phase relationship of the currents in each element (but maintaining equal currents) we can obtain a wide variety of shapes.

Observe in Fig. 3 the null shift as the current phase is changed by 120°, 135°, and 160° respectively. The last illustration, Fig. 4, shows variations of the pattern when a spacing of a quarter wavelength is maintained along with a phase relationship of 135°, but the current ratio is varied from equal to 2:3 and 2:1. In this example, each of the three basic design parameters was varied separately to show how each, in and of itself, can create directional patterns.

In proceeding to the design of a particular pattern shape, one may choose to use one, two, or all three of the basic factors in combination. I will not go into great detail relating to the development of specific field patterns since this is of minimum interest to hams. I will leave it to those needing further information in this area to seek it. My main intent is to impart an understanding of the various techniques for producing a given pattern and what the variables are that affect the pattern. There does, however, remain one other factor of great interest to the ham and that is the effect of antenna height.

Relationship of Antenna Height to Radiated Power

The height of the antenna as related to its output power has not been a subject appearing in ham journals, that I know of, yet it is one of interest. For example, with a single tower of 0.25 wavelength in height with an input power of 1 kw at its base, there will exist a field strength of 196 millivolts per meter (measured at a distance of one mile). But for this same power fed to a .5-wavelength element, the field intensity measured at one mile will be 237 mV/m. This is an increase of 41 mV/m over the quarter-wavelength element yet the driving power remains unchanged. Extending the tower to the most effective height of 0.625 wavelength (5/8λ), the tower efficiency becomes 274 mV/m for a power gain of 2.4 dB, a 72% increase in the radiated power. Any further extension of the length produces unwanted side lobes and a drop in efficiency.

In all of the above, ground radials are at least 1/4 wavelength. Figs. 5 and 6 graphically portray the above statements. Curve A in Fig. 5 illustrates the relationship between field intensity and the fractional-wavelength height of an antenna radiating a 1-kW signal. (Disregard curve B as it does not apply to this subject.) For the record, most but not all broadcast antennas are just short of a quarter wavelength in height, and this will be explained when we get into "Radiation Impedance," below.

Rotation of Signal Using Fixed Verticals

In a directional system using two or more driven elements, there is a term called "tower line" which is the bearing (or direction) of the row of towers. It is on this line that the field pattern is oriented. With the use of four towers arranged in a square pattern, one can drive any two and change the tower line and direction at will, a practice often used by ham contest operators.

Radiation Impedance

This brings us to the quarter-wave tower base feedpoint. The radiation resistance of an antenna is measured at the point of maximum current. On a resonant antenna, both the voltage and current fed at this point would be purely resistive with neither a capacitive nor inductive component, $R + jX_0$. This is the

point that many hams regard as the 50-Ohm impedance point, and some try to force the issue by placing a vswr-indicating instrument at the source end and then, with some dismay, purchase an antenna tuner and proceed to reduce a 1.6:1 vswr or higher to unity.

Wrong! What they successfully did was to provide a conjugate match between the source impedance and the transmission line. The vswr is still 1.6 to 1 or whatever it was at the onset.

We will ponder this further after first investigating the feedpoint impedance of a quarter wavelength with a ground system of 120 radials. The actual impedance of such an antenna measured at its base feedpoint is 36.5 + j22 Ohms. The + j22 in the impedance value indicates that the antenna is not truly resonant but has 22 Ohms of inductive reactance vectorially added to the antenna resistance. The indication shows that the antenna is somewhat long. If the antenna looked like R + jX_0, it would be purely resistive with neither an inductive nor capacitive component, and all of the power getting into the antenna would be effectively radiated.

Let's drop back a bit. Broadcast stations using quarter-wave radiators do not in reality have quarter-wave radiators but something on the order of 0.22 and 0.23 wavelengths. Resonance actually occurs between these two figures, and at this length the radiation resistance is actually 32 + j_0, or 32 Ohms of pure resistance. I can hear the question. "What vswr is that when fed with a 50-Ohm transmission line?" It's 1.53:1. Later I will explain why it is nothing to worry about. The commercial stations don't, so why should you? I will also go into the effects of reducing the number of radials in the ground system.

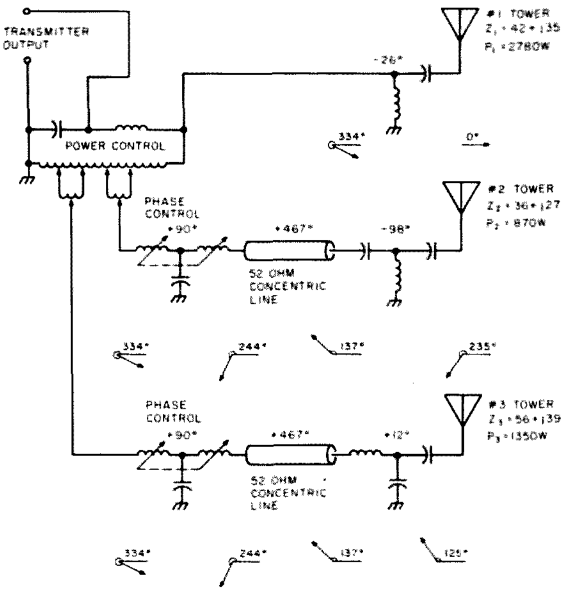


Fig. 7. Three-tower network with in-phase loads.

First, there is another piece of information of interest. You possibly are wondering why I always refer to broadcast antennas. I do this because I am convinced that there is much some of us can learn from the commercial stations, as they have efficient antenna systems and have been designing them for a very long time. For example, here is a small tidbit of information you can reflect upon possibly when measuring your signal at a distance, using a calibrated field-strength meter. I previously mentioned that a quarter-wavelength antenna fed with exactly one kilowatt of power produces a field strength of 196 millivolts per meter (196 mV/m) at a mile distance from this source. Conversely, should we measure the field strength at a distance from an efficient antenna, we should be able to mathematically calculate the power in the antenna that radiated this field strength. The distance then is directly proportional to the current flowing in the base of the antenna.

Taking the radiation resistance of 36.6Ω for a 1/4-wave antenna and using basic Ohm's Law, I = E/R and P/E and $\sqrt{P/R}$. By knowing the field strength of 196 mV/m at one mile, we want to determine the proportional field strength that one Ampere will generate or the number of millivolts per meter per Ampere. The proportional formula with values plugged in reduces to E = 196 mV/ $\sqrt{1000 \text{ Watts}/36.6\Omega}$ = 196/5.23 = 37.5 mV/m/Ampere. Solving for the total current in 196 mV = 196/37.5 = 5.23 Amperes.

According to this, there should be 5.23 Amperes flowing in the base of that antenna one mile from where the field strength was measured. Stay with me a little longer and you will see where this could come in handy.

Back here at the antenna, let's prove that this really is the current in the antenna base. This time we will use the voltage, power, and resistance as measured at the antenna base. We already have all of the formulas: E = $\sqrt{P/R}$ = $\sqrt{1000/36.6}$ = 191/31 volts, I = E/R = 191.31/36.6 = 5.23 Amperes. That's exactly what we came out with in the above calculation. We have correlation. Taking the final step (196 mV/m)/5.23 = 37.48 or 37.48 mV/m/Ampere, which also correlates with the figure of 37.5 above. For those of you who already know this it may have been a bore, but for those who do not, it was good exercise with your calculator.

FCC Rules

In the broadcast field, it is an FCC requirement that stations protect the service area of others that were there on the same frequencies first. Therefore, because of the longer propagation at night, some stations must reduce power at local sunset and some must leave the air. Some stations require such wild field patterns in order to protect the area that they may utilize an antenna system of 12 or more towers laid out in a 4 × 3 pattern in order to protect the service areas of other stations.

Field-pattern requirements are usually drawn on a map of broadcast-station locations. The math to produce the required pattern is exceedingly involved and, even with a fine calculator, would require many hours or days of time to resolve. Therefore, the data is programmed into a computer, and in short order, a multitude of facts, including the magnitude and phase angles of the driving currents for each tower, is obtained. (Actually, there are only a few institutions that will produce plots—for a fee—and there are not too many programmers able to produce the required program for the job.)

Phasing the Currents

Some ham switch-phased arrays use a simple system consisting of varying lengths of coax cable to phase and control the currents feeding the elements. For those interested, Fig. 7 is a typical schematic of a broadcast phasing network used with a three-tower system.

Low Vswr Can Spell Trouble

I have mentioned that the

radiation efficiency is affected when only a few ground radials are used. Let's examine what happens when we use only 15 radials instead of 120. With 15 radials, the ground loss becomes approximately 16 Ohms, and if we remove additional radials, one at a time, the increasing ground resistance increases the total radiation resistance so that we get closer to 50 Ohms, along with reduced swr. Sounds good? This is mistake #2.

When enough radials have been removed for the ground loss to reach 18 Ohms, the total radiation resistance will be 50 Ohms for a perfect one-to-one match. Most hams become very happy and satisfied when they get to this point. However, while the swr went down, so did the radiated power, because now the power is dividing between the 32 Ohms of radiation resistance and the 18 Ohms of ground-loss resistance. Thus the radiation efficiency becomes the radiation resistance divided by the total resistance:

$$\begin{aligned} n &= Rr(100)/(Rr+Rg) \\ &= 32(100)/(32+18) \\ &= 64\% \text{ efficiency} \end{aligned}$$

Yes, you may have achieved unity vswr and a well-matched line but you are burning up the ground with almost one third of your power. I refer you at this point to the very excellent series of articles by Walter Maxwell W2DU/W8XHK, "Another Look at Reflections," and I encourage you to locate the issues and read them. (See References.)

Compromise Ground Systems

Unfortunately, some of us have to go this route when there just is no place to put the radials. A ground system with only two to four radials, although better than none, may have a loss resistance as high as 30 to 36 Ohms, and it is the ground loss that holds the vswr to the low value of 1.4 or 1.5:1 even though the antenna may be off resonance and over half of your power is lost to ground resistance.

Transmission Line Loss

One often wonders how the pre-WWII ham ever got an antenna system to accept and radiate a signal. You are aware that the vswr indicator wasn't invented until after that war. The neon bulb was the standard way of observing standing waves on a line. It wasn't all that difficult because coaxial cable hadn't been invented, either. The standard transmission line for the ham station was 600-Ohm open wire separated by six inches using oak-wood spreaders boiled in paraffin wax. The vswr on the line was, unknown to the ham, more often than not, 10, 15, or even 20:1. But don't feel sorry; he probably got more signal into the antenna than many hams do today.

Yes, there was always some type of tuner between the final and the transmission line, but this usually was built-in as part of the final amplifier. No, the pi network was not a popular tuner of the time. Well, how is it that hams fared so well without a wattmeter or vswr indicator?

The easiest way I can explain it is that the ham of the time did not know too much nor care too much about the standing waves on the line. The main issue of concern was to keep the rf out of the shack and off the microphone, so this usually meant adding more transmission line to the system in an attempt to get a half wavelength so that the line would look the same at both ends. The real truth of the matter is that 600-Ohm open line is one very good transmission system even in today's world because the loss on the line is exceedingly low.

The biggest villain is not swr at all but line loss. High vswr indicates that a substantial portion of the electromagnetic energy is being reflected back from the load to the source, but with an antenna tuner one can create a conjugate match, thus matching the impedance of the source to the transmission line. This, contrary to popular belief, does not change the vswr on the line one iota. With low-loss lines, the portion of energy lost to vswr is exceedingly small. Repeating: the thing to be concerned with is the attenuation loss in the line. This is the main concern, and once you know what this loss is then you will know how much vswr you can stand before the combination gets significant.

Exactly What Happens

With swr, some of the energy will be reflected back down the line due to the difference of transmission-line impedance and antenna-load impedance. However, the energy going back toward the source will reverse and go back up the line. This process may repeat several times in a matter of microseconds until all of the energy reaching the antenna is eventually radiated into space. With a low-loss line, almost all of the energy will eventually be radiated.

Now the villain. With loss or attenuation on the line, part of that energy is absorbed on the way back down the line and again back up the line, and this is where the bulk of the loss occurs. For example, let's say you have 100 feet of coax and the loss for the frequency is 3 dB; one half of the signal reflected down the line is absorbed, and again, when the remaining portion is retransmitted up the line, another half is absorbed. The swr isn't the element that is sopping up the power, it is the line loss, and 3 dB could be what you wish you had.

This, of course, depends on the type of coax and the frequency you are using. The higher the frequency, the higher the loss. Don't you wish you had 600-Ohm open-wire line? So the next time you are tuning up your antenna and are worried about swr, first consider the loss contributed to line attenuation. There are published charts in most antenna handbooks giving this information.

Other Considerations, and the Good Old Vacuum Tube

The good part about vacuum tubes is that they are very forgiving. Not so with solid-state devices. Therefore, most solid-state amplifiers have built-in safety features like Automatic Limiting Control (ALC). The presence of swr sends back a proportionate out-of-phase voltage that biases the driver so as to reduce the drive or even shut it off should the swr be high enough. A tuner then becomes a must with solid-state amplifiers. Solid-state devices do not like to see a mismatch between the transmission line and the amplifier. Thus, a tuner will give the conjugate match needed between the line and the amplifier, allowing the amplifier to put the full power into the transmission line.

Recently, while reading the mail on a cross-country QSO, the party on the far end stated that he was using a solid-state rig and had an swr of 1.6 to 1 without the tuner. An S-reading was taken by the party in QSO and a second reading was taken after an antenna tuner was switched into the line. I don't remember exactly, but the results were an improved signal strength of about one S-unit, or 6 dB. Actually, the tuner provided a conjugate match between the transmitter and transmission line—the vswr was still on the line. The signal was improved because the transmitter was now transmitting its full power, as the ALC was no longer biasing back the drive to the final.

Conjugate Match

If the line between the tuner and transmission line were separated or broken, and two impedance readings were taken, one looking back into the tuner and another looking into the line toward the load, the first would see the conjugate of the impedance seen in the opposite direction—$R + jX$ in one direction and $R - jX$ in the other. The conjugate match has made the internal resistance of the source equal to the resistive component of the line, and all of the residual reactance components have been canceled to zero. When these conditions are met, all of the transmitted power enters the line.

Walter Maxwell graphically illustrates (and, I think, conclusively) another example of vswr equated with line loss. Using his example, 80 meters is a very wide band and an antenna would have to have an exceedingly poor Q to be reasonably flat across it. If a dipole is cut and resonated at 3.75 MHz (the center of the band) and fed with 100 feet of 50-Ohm RG-8/U coax, the vswr at both ends of the band (3.5 and 4.0 MHz) will be about 5:1. The loss in the coax adds only 0.46 dB to the matched or flat line loss of 0.32 dB at 4.0 MHz. So, at the band ends the loss is equal to 1/12 of an S-unit because of vswr. Not very much to be concerned with is it? Not at all what many hams would expect, so why would one worry about a 5:1 vswr under these conditions?

If the final amplifier is unhappy with the condition, match the line to the amplifier by use of a tuner, but remember that although this also may make you very happy, you still have 5:1 swr but are transmitting just about all of the electromagnetic wave.

With all of this freshly in mind, you might ask yourself the following questions:

1) What attenuation is introduced to my signal between the final amplifier and the antenna?

2) What is my vswr?

3) What is the loss due to swr alone?

4) What is the total loss due to swr and transmission-line loss?

5) To what extent is my solid-state power amplifier powered back due to swr?

6) Do I need an antenna tuner?

7) What is the ground-loss resistance?

8) What is my power loss due to the proportion of ground loss to antenna resistance?

9) What is the radiation resistance of my antenna measured at its current feedpoint, less the ground-loss resistance?

Now, if you want to know more about the magnetic field, the electric field, and the combined electromagnetic field that is transmitted into space, read "The Radiation of Radio Signals," by W1GV (see References.)

I trust that the information presented here will shed new light on what is going on in your antenna system and provide significant points to consider for improving the situation. ■

References

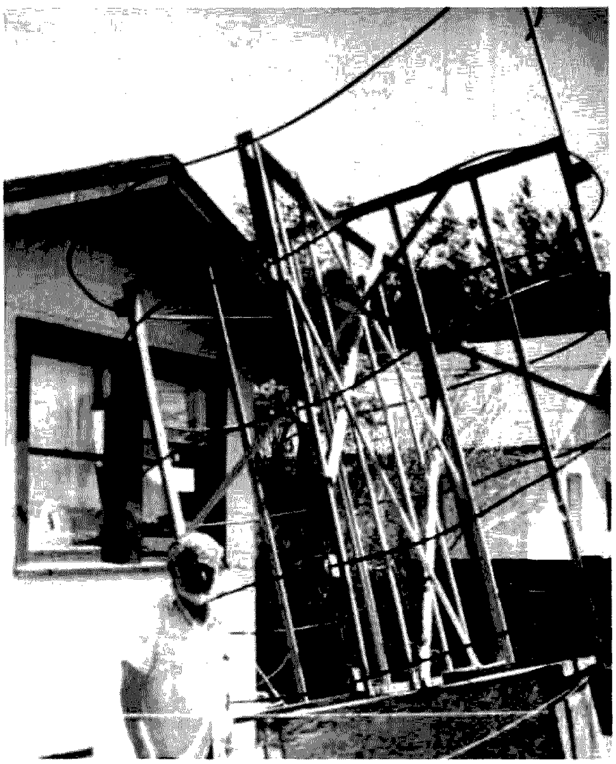
1. "Exploring the Power Myth," Hubert K. Woods W9IK, *73*, May, 1976. (Note: There is controversy between W9IK and W2DU on this point.)
2. "Another Look at Reflections," Walter Maxwell W2DU, *QST*, April, June, August, October, 1973, and April, 1974.
3. "The Radiation of Radio Signals," Stan Gibilisco W1GV, *Ham Radio*, June, 1982.
4. "How to Design Yagi Antennas," Joseph H. Reisert, Jr. W1JR, *Ham Radio*, August, 1977.
5. "Ham Radio Techniques on Measuring Vswr," Bill Orr, *Ham Radio*, April, 1982.
6. "VHF/UHF Techniques," Joseph H. Reisert, Jr., *Ham Radio*, July, 1976.

Ollie B. Boddie W1ZB/6
45151 Cedar
Lancaster CA 93534

Ollie's Folly

Circular polarization on HF? A forty-meter helix with oil-drum forms? W1ZB's signal runs rings around the rest. Folly, indeed!

Circular polarization is very old, almost as old as radio itself. In 1953, I was working for the leading radar antenna company and was hired by the US Government to evaluate circular polarization. After two years of extensive field tests, circular polarization was found to be superior for transmission and reception over mountains and through rainstorms. When satellite tracking stations came into existence in the late 1950s, circular polarization was used exclusively for Doppler-effect receivers and is still in use today.



The author and his 20-meter helix.

Twenty years later, I wondered why not use this same principle on high-frequency receivers and transmitters. If it works well on VHF, it will work well on HF. The only limiting factor is the size of the array for HF. After many years of experimenting in the Mojave Desert and on my antenna farm at Otter Creek, Maine, we have working models for most of the HF bands.

VHF antennas have always used one wavelength for the circumference of the helix. After much trial and error, we have found that HF, circularly-polarized antennas will work very well with a circumference of one-half wavelength. The tuning is very broad and will cover two bands.

Construction

The best thing to use for

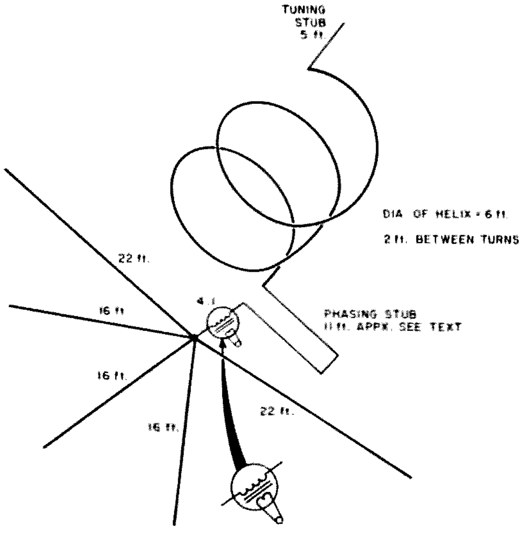


Fig. 1. Circularly-polarized, ground-mounted antenna for ten and fifteen meters.

the helix is a 3/4" rigid or semi-rigid coax of the type used for cable TV, available in most parts of the US. Only the outside conductor is hooked up during operation. The helix can be mounted with two wooden supports, 2" × 2" or 2" × 4" studs, for top and bottom. Pipe clamps are used to hold the coax onto the wood. It can also be hung on a slanting rope between trees. The wire used for the reflectors can be #18, #16, or #14 copper wire, covered or uncovered. The phasing section is a one-half wavelength of TV line (300 Ohms) resonated (dipped) with a MOSFET dipper or grid dipper to the frequency. The line is then coated with two coats of varnish to protect it from the weather.

In winding the helix, I used a big oil drum and a big water tank to wind it into shape. We had quite a search all over town to find something big enough to wind it around. Working the two sections of the antenna in phase results in a superior field pattern with a narrow beam of high intensity. Gain is 2 dB per turn. Use seven turns if possible, although a three-turn helix will work well.

Band	Diameter of Helix	Approximate Phasing Stub Length
40m	20 ft.	32 ft.
20m	10 ft.	16 ft.
15m	7 ft.	11 ft.
10m	5 ft.	8 ft.

Table 1. Construction dimensions for circularly-polarized antennas.

The helix must be tilted at a 30-degree angle, otherwise all your power will go into the ground. A balun or tuned feeders work fine. The antenna is ground-mounted, with the base of the helix a few feet off the ground. The reflectors are a few inches off the ground with the center one slanted backwards in an almost vertical position. Two wooden posts are used to hold the front end of the helix at the proper angle of 30 degrees.

Tuning

When the antenna is completed, couple the grid dipper or noise bridge to the balun with two turns of wire. The balun ratio is 4:1. Adjust the stub at the end of the helix for resonance. It should be very broad. Tune it for 21.4 MHz and it should work on 10 and 15 meters. Coax/balun feed and tuned feeders have both worked well.

After eight years of testing, I can safely say it outperforms any yagi or quad of the same size. A 10-ft.-diameter helix works well on 20 meters.

$$L = n\sqrt{c^2 + s^2}$$

$$L = \sqrt{a^2 + (n\pi d)^2}$$

where:
n = number of turns
c = circumference of each turn
s = lead or spacing of turns
a = length of the helix
d = diameter of the helix
L = length of rigid coax

Fig. 2. Formulas used to determine the optimum dimensions for circularly-polarized antennas.

No matter what kind of antenna you have, the polarization of the received signal a thousand or more miles away will be different from the one sent out by your antenna. Extensive testing of dipoles and beams over a path of 500 miles has shown the signals to be coming in at a 45-degree angle on most HF bands. The circularly-polarized antenna was better able to cope with this phenomenon and showed a remarkable gain over any conventional antenna. ■

See List of Advertisers on page 80

L. B. Cebik W4RNL
2514 Dereck Drive, H-1
Knoxville TN 37912

Build a Better Box

Most hams cram their circuits into any old case that's handy, but a little planning can turn a so-so project into a masterpiece of packaging.

The projects we design and build are often electronically better than their commercial counterparts. Often they just don't seem to be as good because we fail to take the trouble to package them so that they will give us the operating convenience, appearance, and safety of commercial gear. Granted that very complex projects involving combinations of rf, af, and digital circuitry do require fancy cases and extensive internal cabinets to shield one circuit from another. However, for most simpler ham projects we can do just as well as the factories in mounting our electronics in cabinets that are convenient, safe, and attractive. And we can save money in the process, whether we build or buy our cabinets.

There are many ways to make good project cabinets or to mount projects in them, but a number of basic ideas can open up our imaginations to improve our gear. Let's take a look at some principles and ideas that I have accumulated over the years. Since I am not an expert in metalwork, all the ideas below will work for anyone with no more than two or three thumbs per hand. The basic mechanical tasks of building up the final stages of a project are not difficult, so if you have some special skills, you can expand on these ideas in ways I probably have not even dreamt of.

What's a Good Cabinet?

A good project case or cabinet is more than an attractive shell to surround electronic circuits. We place our circuits in cases in order to meet some very special needs. Therefore, we should begin thinking about project cabinets even before we build the circuits to go in them. If we are reproducing a circuit from a magazine, the author's version may give us some good ideas, but let's not stop there. We will be using the project we build. We should design the cabinet to meet our own special needs, not those of the author. There are five major jobs for the cabinet.

Function: A cabinet must permit the electronic project to perform its function effectively. In fact, the cabinet should enhance the function. If there are controls, all of them should be accessible to us according to how often we need to operate or adjust them. All controls should be well spaced so that we do not maladjust one control while using another. We must have access to connectors as well as controls. Often-used jacks and plugs need to be where we can reach them easily without interfering with the controls. If there are meters or other readouts, we must place them for convenient monitoring. Our care in designing a case that will hold all these controls, readouts, and connections will determine how useful the equipment will be to us in the long run.

In the era of boat anchors—when huge cabinets full of tubes provided large panels—we could place almost every control, meter, and jack on either the front panel or the rear lip of the chassis base. In today's world of miniature electronics, panel components may occupy more room than all the circuitry put together. For many small projects, the front and rear panels may provide enough room for controls. However, there is no rule that says we have to restrict ourselves to these surfaces. Any surface on the case that makes a panel component accessible (without creating special building problems) is eligible for use. A new generation of commercial sloping-front cabinets offers the builder new options in packaging. We can use these cases—or home-brew equivalents—to improve the basic performance of our projects.

Support: As in the beginning of electronics, the cabinetry must still support the electronics. A case provides surfaces to mount the chassis and circuit boards on or against. Just mounting circuits to get them out of the way is not enough. We should plan access to the circuits for adjustment and repair. We used to mount all the individual parts of complex transceivers on one chassis base. Today, we tend to use numerous subassemblies consisting of circuit boards and small metal enclosures, each interconnected by cables. To make repairs, we should only need to dismount one of the subassemblies.

The cabinet must not only support these boards and subassemblies, it must also give us access to them. One common problem for new builders is the urge to strive for excessive miniaturization. We cram together all the parts in minimal space. As long as everything works well there seems to be no problem, but such units are susceptible to mechanical shock damage. And we dare not open the case for repairs lest the tangle of parts and wires engulf us. A good cabinet supports our work neatly and in a way that minimizes potential damage to the circuits.

Shielding: We have mentioned using small metal cases within the project cabinet. This is just one way to

keep circuits isolated from each other when there is danger of an undesired interaction. A digital readout in a transmitter requires careful isolation. Vfos need isolation from both electrical and mechanical interaction. Other circuits may require less shielding; an aluminum sheet used to support a circuit board may also supply all the necessary shielding. We must also watch out for interconnecting cables; keeping the signal leads short, direct, and shielded. The power-supply lines, traditionally cabled together and run around the perimeter of a chassis or cabinet, are susceptible to signal pickup and transmission. We need to use care not only to bypass all power leads, but also to route them where they can create the fewest problems.

A good project cabinet must make room for all these adjuncts to the circuitry. Without room for shielding and isolated cable runs, even the best circuits are likely to give us surprising and undesired results. Size is not the only factor. A cabinet must provide surfaces that can support shields and subcases and permit good metal-to-metal contact to ensure a common ground for the project. Not all projects require such attention to shielding. Many circuits are totally noncritical in this regard, and thus can live comfortably in non-metal environments. Some thought to shielding will go a long way in our efforts to select the right cabinet for the job.

Appearance: A ham project is a work of pride. You should dress up your project so that even if shack visitors cannot see the magical electronic innards, they can appreciate the external workmanship. Care and neatness with cabinet construction and lettering add to both function and appearance. You can improve appearance without special skills. Touches of wood framing on the cabinet will humanize metal boxes. Some simple masking and spray painting can customize a project. You can either match the general appearance of the commercial gear that forms the nucleus of the shack or you can express your own personality in your cabinets. In fact, with a few custom touches you can add some fun to the function of your projects.

Safety and Security: The last—but not least—major job for the cabinet is to make our project safe for ourselves and others who enter the shack. We enclose electronic circuits in cabinets first *to protect people* from shock and other hazards, and only second to protect the circuits from people. Even today's low-voltage solid-state circuits hold potential for human harm if carelessly handled. Some people are more sensitive than others to electrical currents, so we should never assume that 5 to 12 volts is safe enough for open circuitry. Adults are curious enough, but children simply cannot keep their hands out of things. We need to think not only about the case itself, but about current-carrying connections as well. The project cabinet, when all is said and done, can be an expression of love and protection for the people around us.

A little thought to these requirements for cabinets will help us select or design just the right case for our current project. There is a large number of commercial cases on the market. Some are traditional cabinets with front and rear panels that detach independently. Others make use of fewer metal pieces by forming the bottom and top from two U-shaped pieces of aluminum or steel. Painted and unpainted utility boxes come in sizes from just over an inch on each side to about 8″×8″×8″. Some cabinets have shadow tops that extend beyond the edge of the front panel to prevent glare from overhead lights. Of course, there are the classic rack panel and cabinet, but these are so large and heavy that they have become special-purpose and laboratory items. The average ham may use them only if he is building a large and heavy piece of gear such as a linear amplifier and power supply. Even then, there may be better cases to buy or build.

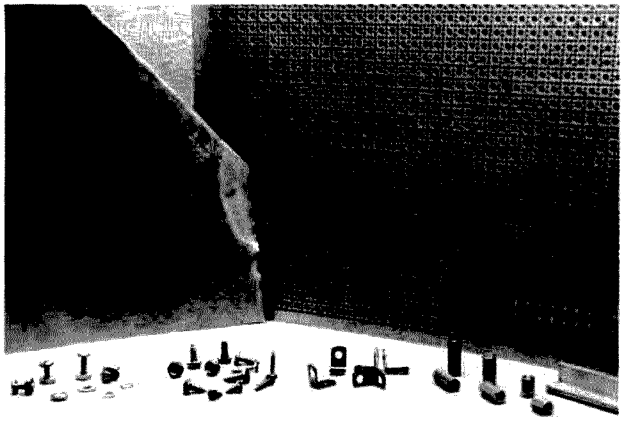


Photo A. Some common items used in cabinet construction (from left to right): 6-32 hardware, sheet-metal screws, L-brackets, standoff pillars, and angle stock. In the background are sections of flashing and perforated metal.

Some of the more recent cabinet innovations open new doors to imaginative packaging. One line of cabinets from Ten-Tec uses a combination of materials, with the front, rear, top, and bottom dividing in unconventional ways. Other cabinets, from a variety of manufacturers, use sloping panels that range from near vertical to almost flat. A few use a combination of slopes to provide room for the combination of keyboards and panel controls. For most of these new ideas we must pay a premium, and these cases are usually accessible only through mail-order sources. Local stores such as Radio Shack carry a limited number of cases, mostly for smaller projects. However, if a cabinet will make the difference between a successful, often-used project and one that gathers dust in the corner of the shack, the extra cost is justified.

Over the years, we will use many different types of cabinets for our projects. Some circuits will be wrapped in commercial cases. Others will be put in one-of-a-kind cabinets. Still others will go into cases that are a combination of both. The materials available are readily adaptable to modification, and the more we perfect our cabinetry thinking, the more materials we will discover to be useful in packaging our projects.

Home-Brewing Cabinets

The whole idea of building a cabinet for a project may seem scary at first. However, the skills, tools, and materials are all fairly easy to acquire—if we do not already have them. Patience and neatness may be the hardest items of all to develop, but with them we can be successful on nearly every try.

Any number of materials will come in handy in cabinet construction. Solid aluminum sheet ranging from 16 to 20 gauge (.05″ to .03″) is the most common material. Steel in 18 to 22 gauge

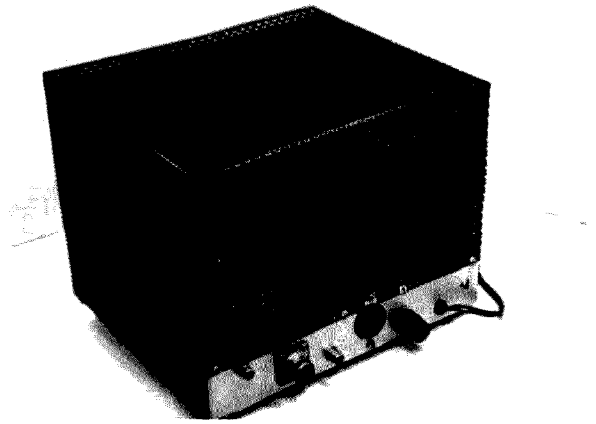


Photo B. A CW transmitter using a home-brew panel and perforated-aluminum shell around a commercial chassis base.

has the same thickness range but is harder to work on without tougher tools. Metal shops in your local area may be able to supply small quantities of sheet metal fairly inexpensively. If you get to know the shop people, they can give you good advice on working the material. Perforated aluminum is available from some hardware stores and makes a good shield at lower frequencies. It is thin enough to work by hand, but it will not support controls. Aluminum flashing is also very thin and workable and makes good subassembly enclosures and solid shells. Building-supply stores usually stock this, and it can be cut with heavy shears.

Metal is not the only good material for cabinets. Not only will you find plastic cabinets in radio-parts stores, but you also will find them in five-and-dimes if you learn to look. Kitchen supply, household goods, and home/office supply departments carry a variety of plastic boxes and enclosures, many having just the decorative touches to make your project attractive. If you do not need the cabinet to serve both as a shield and as an enclosure, do not overlook these sources. Similarly, if your cabinet does not have to double as a shield, wood is an attractive cabinet material (as a look at any antique radio will attest). Do not be afraid to try something different, even if commercial manufacturers have turned away from such techniques for economic reasons.

The actual process of making a cabinet is not difficult. Let's look at several different styles of cabinets we can make in our shops or even on the kitchen table. We will need a few tools in addition to those we keep in the shack. Here is a list:

- Hacksaw
- Saber saw with sheet-metal blade
- Small metal brake
- 1/4- or 3/8-inch electric drill and bits
- Scrap wood, e.g., a few feet of 1 × 4 pine or fir
- Clamps (to hold metal to the wood or brake)
- Files: flat and half-round in several sizes

(This list assumes that the usual collection of screwdrivers, pliers, and other common household tools are available.)

We can make some cabinets without bending a piece of metal. Fig. 1 shows the general idea. Using 1/2"- or 3/4"-wide aluminum angle stock available at metal shops, we can cut the pieces for a cabinet frame. The detail in Fig. 1 suggests how to cut the ends of the stock to bolt pieces together with 6-32 or 8-32 hardware. Cover the frame with solid- or perforated-aluminum sheet, depending upon the needs for each surface.

Fig. 2 shows a similar use of perforated aluminum where a chassis base supports the project circuitry. Attach a 16- or 18-gauge piece of aluminum to the chassis to serve as the front panel. Then, for a shell, cut and bend perforated aluminum. Use 6-32 nuts and machine screws to secure the seams of the aluminum. Then fasten the shell to the chassis with no. 6 sheet-metal screws. The shell forms a shadow lip over the panel. Although the shell will not withstand physical abuse, there are many applications where this construction works well. We can stiffen the edges by adding common 3/8" angle brackets (available at radio-parts shops) every few inches at the bends, seams, and especially near the corners. (Photo B shows a small home-brew CW transmitter that uses this technique.)

For both these cases, you need only heavy shears, a saber saw, and a hacksaw. Cutting work is easier if you clamp your work to a bench or another solid surface. A bench vise to hold the angle stock for cutting is recommended, but you can use clamps to hold it to the edge of a bench. Cutting will always leave burrs and sharp edges: bevel them with a file.

Since all these operations leave handprints on the metal surface, you should think about painting the finished product. There are solutions which clean aluminum, but the simplest procedure may be to use very fine (000) steel wool on the surface and then spray paint it. Use sev-

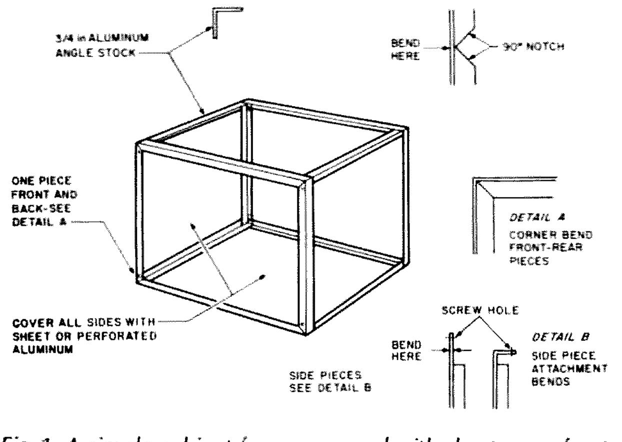


Fig. 1. A simple cabinet frame, covered with sheet or perforated metal.

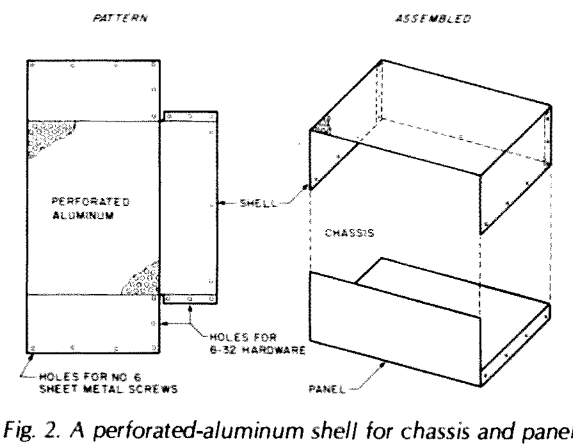


Fig. 2. A perforated-aluminum shell for chassis and panel.

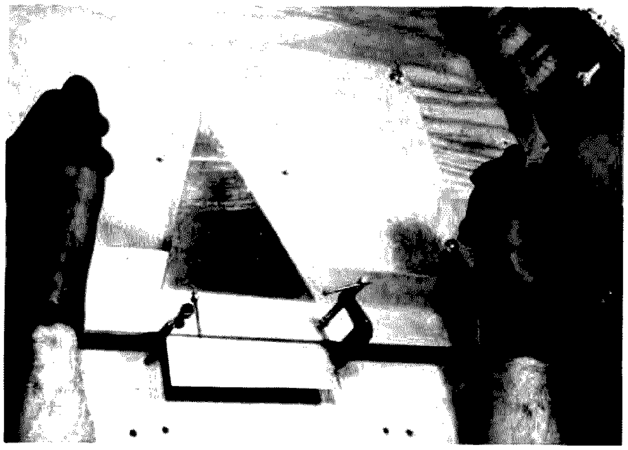


Photo C. A metal-bending brake in action; note the use and position of clamps and the method of operation.

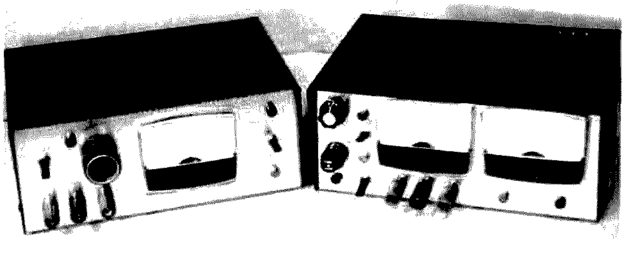


Photo D. Two power supplies. One of these look-alike units has a home-brew sheet-aluminum panel (U-shaped bottom piece).

eral very thin coats rather than the one thick coat that inevitably runs. If you use just one or two passes of a pressurized can of spray paint for each coat, you can build up a textured surface in about five to seven quick-drying coats. A large cardboard box makes a good disposable paint station to catch the excess spray. Of course, delay any painting until you have done all the necessary drilling and cutting on your panels.

So far, we have not used the metal-bending brake. Bending brakes are simply devices for making long, even bends in sheet metal. Small cast-aluminum hand brakes for light-metal work are available for about $25.00 from mail-order tool suppliers. If you have larger work, you may want to pay a metal shop to make the bends for you with its sophisticated heavy-duty equipment. For small aluminum cases as well as shields and plates that require a mounting lip, the light brake is handy. The brake usually has a clamp bar to hold the metal in place. As Photo C shows, the movable part of the brake bends the metal sheet evenly. Use steady force on both levers in order to bend the metal smoothly. The clamp bar usually will permit you to bend the metal slightly more than 90° so that the metal returns to a true right angle when you release bending pressure.

To make a box, design two U-shaped pieces. You can add a lip to the bottom piece in order to seal the box with sheet-metal screws, or you can add lengths of aluminum angle stock to receive the closure screws. Fig. 3 shows the unbent and bent pieces. Use 18-gauge aluminum which works easily and provides good support for small projects. If you examine inexpensive commercial enclosures, you will discover that they are designed in almost exactly the same way. Add holes for controls and connectors, a coat or two of paint, and lettering to identify the knobs—and the enclosure is complete.

Fig. 4 shows a slightly more ambitious box with a shadow top and lips on several sides to receive sheet-metal screws. This enclosure requires several bends per piece. Make the lip bends first. Then cut from scrap aluminum or steel stock a special clamping bar to fit within the lips so that you can make the large bends. Note that the lips do not go all the way to the ends of the pieces so they will not interfere with the large bends. This box provides a tighter electrical shield for the circuits inside.

Often, you do not need to construct an entire cabinet. As time moves on, you will accumulate old cabinets from projects that have outlived their usefulness. One or more pieces of an enclosure may be in excellent shape. You need only replace the parts which have

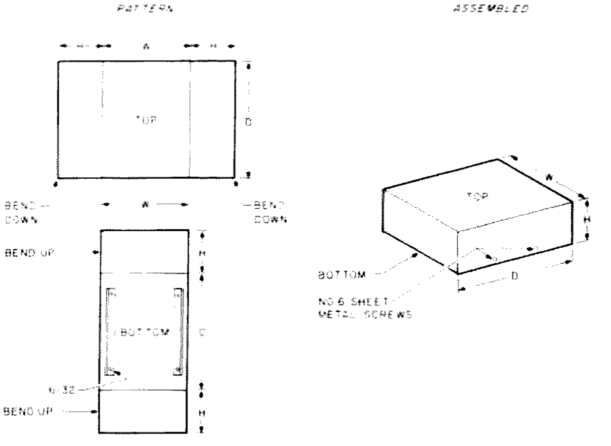


Fig. 3. A simple cabinet made from two U-shaped metal sheets.

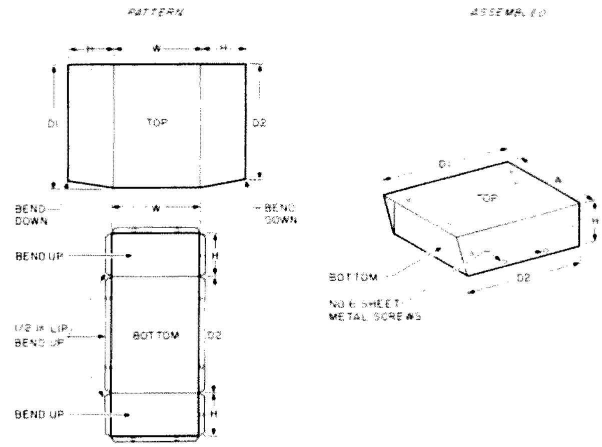


Fig. 4. A more complex version of the cabinet in Fig. 3.

too many holes in the wrong places. The original piece serves as a perfect guide for bending a new one. Photo D shows two power supplies in identical boxes. One supply, however, has a home-brew aluminum bottom to go with the dark top left over from a dead project. From the photo, I cannot tell which is which.

Fig. 5 is an example of hybrid home-brew cabinetry. The cabinet is a common chassis base. The bottom plate is perforated aluminum. With a coat of paint and cutouts, this unit holds a CW keyboard. The decorative wooden end pieces, stained and varnished to match other furniture in the shack, are also functional. By screwing the chassis to the end pieces at an angle, the unit provides a sloping panel to match the keyboard slope. Yet the entire cabinet costs less than a quarter of the price of comparable commercial keyboard cabinets. Photo E illustrates the finished unit.

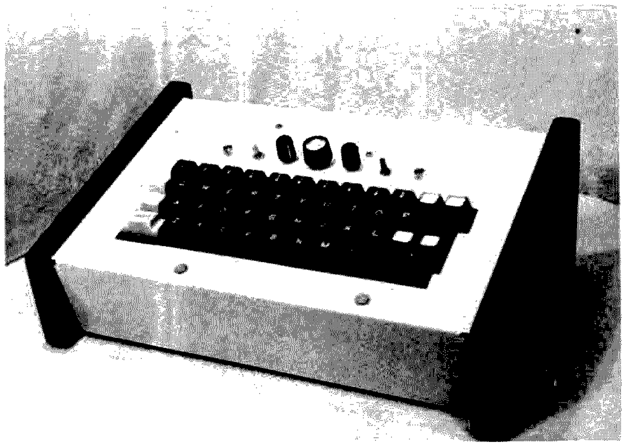


Photo E. A hybrid cabinet using a chassis base and wood end pieces to support a home-brew CW keyboard.

Panel Work

Now that you have a cabinet, whether home-brew or commercial, the next step is to make the cutouts for controls, connectors, and readouts. This job requires a bit of planning and some patience. There are a number of additional tools that will make the job easier:

- Circular hole cutters for your electric drill, 1-1/2" to 3" diameter
- Nibbler
- Chassis punches, 1/2" to 1-1/4" circular, plus other shapes as needed
- Center punch
- Hand reamer, 1/2" maximum diameter

All of these tools are available from major parts suppliers or hardware stores. As with all metal work, be safety conscious. Clamp your work to a solid base. Wear safety goggles to keep chips out of your eyes. I also recommend that you wear gloves, since burrs and freshly-cut metal edges will cut skin very easily. Keep your tools clean and sharp. Dull tools are more dangerous because they slip more easily. Finally, keep your attention focused. A dull or tired mind can be the most dangerous tool of all.

Before cutting a cabinet panel, make several sketches of your desired cabinet layout to be sure all the holes you cut will be exactly where you want them. Paper is much cheaper than ruined cabinets. In drawing your layout, there are a number of matters so obvious that every builder overlooks them occasionally. Here is a starter list. Your own mistakes over the years will give you additional entries.

- Be sure to leave clearance inside the cabinet for closing screws. Some sheet-metal screws can extend up to a half inch inside the cabinet, which would jam circuit boards or short out wiring.
- Beware of controls and jacks that come too close to closure screws.
- Leave room for finger access to any interconnections between subassemblies. Allow for in-line connectors if your project uses them.
- Allow clearance between subassemblies not only for maintenance, but also to compensate for minor inaccuracies in cabinet cutting and drilling.
- Leave clearance for controls or switches and for their connection terminals. When laying out a panel, it is easy to forget that a control extends behind the panel as well as in front of it. Plan your panel by the control size, not by knob diameter (unless the knob is bigger than the control).
- Even in low-voltage projects, use care with lethal ac leads and components such as fuse holders that extend far behind the panel. Decide in advance whether fuse changes might be regular (as in a bench supply) and choose a panel fuse holder or a chassis clip accordingly.
- Remember that subassemblies have three dimensions. Do not plan with a single drawing, but sketch your cabinet layout from all angles. Trial-fit components into the cabinet before freezing your design.
- Be sure all exposed terminals inside the cabinet will be free and clear of possible short circuits.

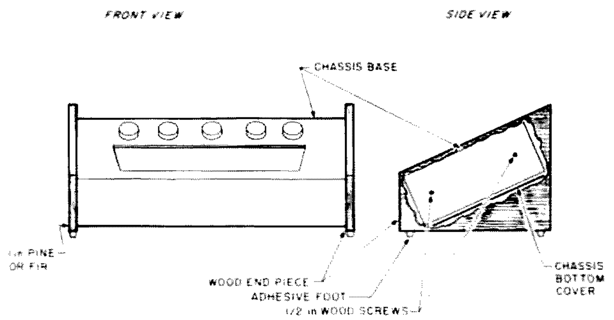


Fig. 5. A hybrid cabinet using a chassis base with wood end pieces.

The list is not complete but is long enough to give you an idea of what can go wrong in the absence of proper planning. I have made each of these mistakes at least once. (A few more embarrassing errors I have omitted from the list.)

Draw your drilling and cutting plan on the cabinet pieces using a center punch to mark all holes. I generally begin cutting using the smallest drill bit that corresponds to a hole, usually a 1/8" hole for 4-40 machine screws or a 9/64" hole for 6-32 hardware. Use a drill bit one size smaller for sheet-metal screws. Then enlarge the holes as needed. Modem miniature controls require 1/4" mounting holes, so a 1/4" chuck in an electric drill will do most of the work. However, some controls require 5/16" or 3/8" holes, and older toggle switches require a 7/16" hole. A hand reamer readily enlarges holes in aluminum. Since most of these tools have thin T-bar handles, wear a work glove to relieve hand fatigue.

For holes larger than about 3/8", we will need other tools. Chassis punches usually require a 3/8" hole for their central shaft (for punch sizes up to about 1-1/2" diameter). We can cut larger circular holes with

drill-driven hole cutters (or hole saws, as they are sometimes called). Starting with a small (1/8″) pilot hole, these cutters drill a larger guide hole and cut out the full-size hole with a heavy circular sawtooth fixture. To keep the metal from tearing as the saw cuts through, clamp the panel to a scrap of wood. If possible, use a slow-speed drill and keep the work cool with a drop or two of oil.

You can cut square or odd-size holes with a nibbler, a hand cutter that takes a 1/8″ × 1/4″ bite of metal at a time. Panel cutouts usually require a 5/16″ starting hole. Then a steady hand and patience will permit a fairly accurate cutout. Leave just a bit of metal for filing. In fact, all cutting tools leave burrs and edges that you will want to file smooth. Filing is a boring job and there is a temptation to cut burrs out with a pocket knife. However, to avoid nicks and panel scratches as well as to achieve perfect holes that precisely fit the components, use round and half-round files along with a good bit of patience. Be sure that the burrs are gone because they can cut the plastic cases of panel instruments (such as meters), and they will affect the way metal panel components fit.

Many of these same tips apply to working with plastic, although a few special cautions are in order. Plastic in the early days was often so brittle that drilling shattered it. Today's plastics are more varied, tougher, and better suited to serving as cabinets for electronic projects. The soft plastic used for test-bench instrument cases drills well. You can cut larger holes often by starting with a smaller hole and whittling it to true size with a sharp knife. These techniques do not usually work well with more brittle plastics. Punching and nibbling are out. However, most modern plastics will withstand careful drilling. If you need a panel full of large or unusual holes (for meters and such), try replacing part of the plastic case with a metal panel.

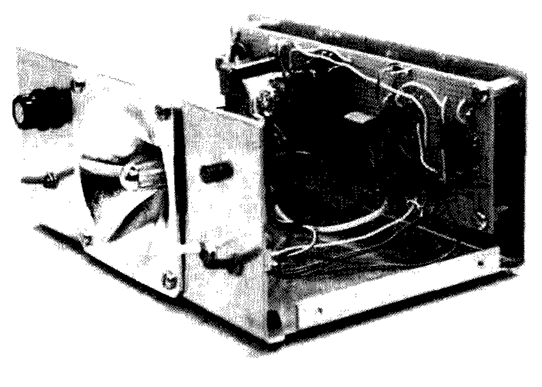


Photo F. An ultrasonic bug chaser with the circuitry mounted against the rear cabinet wall.

Plastic, of course, provides no shielding for circuitry. Aluminum flashing, however, can provide internal shielding beneath the attractive plastic exterior. Fig. 6 shows an example of flashing which is cut and bent to form a shield for a subassembly inside a plastic case. Thin shielding works as well as thick metal, and the commercial trend seems to be to save money by using plastic for structural duty and the thinnest metal (including foil) for shielding. The ease of working with lighter materials suggests that commercial practice may hold a few lessons for ham builders.

Mounting the Circuit Boards

Assuming that you have built up your circuits on some appropriate surface (printed circuit boards, perfboards, terminal strips mounted on board or metal, or a chassis) you are ready to mount them in the cabinet. However, there are two planning questions we have not yet asked. How will you mount them? Where will you mount them? There are many good answers to both questions, and your job is to select the right answer for your project.

Support: Every piece of circuitry deserves a stable and secure mounting to guard against movement inside the cabinet. The advantages are obvious. Movement permits physical damage and shorts among the wires. Manufacturers encase microcircuitry in epoxy to stabilize all connections and prevent parts from moving relative to each other. We should do no less inside our cabinets, although we need not go to the extreme of filling the case with epoxy. Screws will do nicely, as will a few other techniques.

Access: As noted when we looked at cabinets, subassembly mounts should leave us room to connect and service the modules. However, access is not just a matter of leaving enough room for work. It is also orienting the subassembly to make the work convenient. Be sure trimmer pots and other controls point in a direction that allows easy adjustment. Do not create tiers of circuitry boards without a method of easily removing the top layers. Modular design holds many advantages, but it can lead us into many snares if we do not plan carefully.

Isolation and interaction: How we position subassemblies within a case can determine the degree of interaction between circuits. Two boards face to face are more likely to interact than two at right angles to each other. Placing audio circuits close to an unshielded power transformer is a good method of ensuring ac hum in the output. Oscilloscope tubes use mu-metal shields and distant placement of power transformers to prevent magnetic deflection of the scope beam. Vfos and other oscillators in receiving and transmitting circuits require full-scale shielding and isolation from circuits that are likely to produce spurious mixing products. These examples should spur you to think carefully about the relative positions of all subassemblies in order to avoid unwanted interactions.

Heat: Even solid-state circuits generate heat. Power-supply components and power-amplifier transistors are now the main heat sources, but even micropower circuits require a little breathing space. Since hot air rises, leave a vertical path for its climb into the world outside

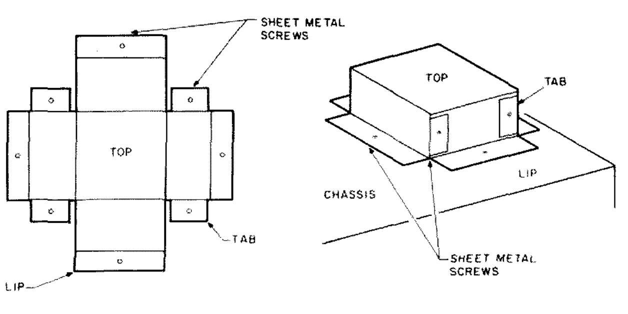


Fig. 6. A simple internal shield made from aluminum flashing.

the case. Add a few ventilation holes to cabinet bottoms so cool air can replace the hot air. Consider mounting power transistors on the rear wall of the cabinet with suitable heat sinks, but be sure the component cases will be electrically safe. Every degree above room temperature is an unnecessary stress on components. Trapping hot air around components can shorten lives and, of course, they will die just when you most want to use the circuit.

Lead length: Wherever possible, avoid long signal leads between subassemblies or between panel controls and boards. Where you must use long signal leads, shield them. Many newer designs are replacing signal leads to controls with special circuits that permit control leads to carry only dc. How you mount your subassemblies will determine how long the leads need to be and where on the subassembly the lead terminals should be. There are many projects in which these considerations are noncritical, but be sure of this fact before you permit a maze of long leads to run between boards.

With these thoughts in mind, we can tackle the hows and wheres of mounting your circuits inside the case. How to mount a circuit depends upon its construction and what surrounds it. Let's survey a few of the more common techniques.

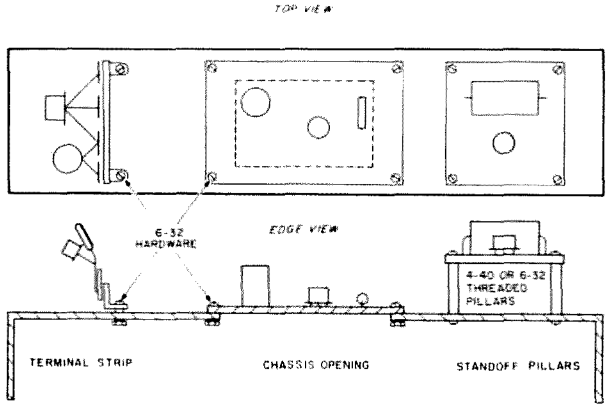


Fig. 7. Three methods of mounting circuits to chassis or plates: terminal strips, chassis cutouts, and standoff pillars.

Fig. 7 shows some of the more common techniques to use with a chassis base or flat metal plate. Point-to-point wiring using terminal strips bolted to the chassis or plate is still a handy construction method for many projects. Perfboard and PC-board circuits can be mounted in chassis cutouts, with 6-32 hardware to secure the boards at their corners. If you do not want to cut the chassis, you can mount boards on pillars that are long enough to ensure clearance for all the terminals on the board. This method has the additional advantage of providing a shield between the board bottom and wiring on the other side of the metal plate.

For mounting boards inside a cabinet, Fig. 8 offers several common methods. These are numerous experimenter PC boards equipped with fingers to fit PC-board sockets. These sockets mount on rails to clear their terminals; however, you can place them on standoff pillars to mount on the bottoms, sides, or backs of cabinets. L-brackets provide a convenient method of mounting light circuit boards. Two boards secured back to back with standoff pillars provide four L-bracket feet. This mounting will be more stable and will carry more than twice the load of a single pair of L-brackets. A simple adaptation of this technique provides a shield between the circuits in the form of an 18-gauge aluminum plate which attaches to the cabinet surface.

Fig. 9 shows some simple methods of mounting subassemblies. L-brackets and 6-32 hardware secure small boxes to cabinets or chassis, as do carefully placed sheet-metal screws. Even panel controls protruding through the subassembly box can supply a good hold for light circuitry. However, we do not always need hardware since a little foam material can hold a circuit board in position if we are careful not to stress any tall or fragile components. This technique is often useful with plastic enclosures or small subassembly boxes.

Each of these techniques has its advantages and limitations. Circuit-assembly weight, the need for inflexible mounting, requirements for shielding, and other factors determine the right mounting for each circuit. Also, where the circuit belongs in the cabinet has a bearing on the mounting method you choose.

The first idea to throw away is that you must bolt your circuit board or chassis flat to the bottom of the case. This holdover from the days of tubes and chassis bases has only limited application today. It applies to power supplies and other circuits using heavy components. Lighter circuits can mount against almost any surface of the cabinet and in almost any orientation. Some of the photographs may be suggestive of the possibilities. Photo F, the ultrasonic bug chaser, shows the circuitry board mounted against the

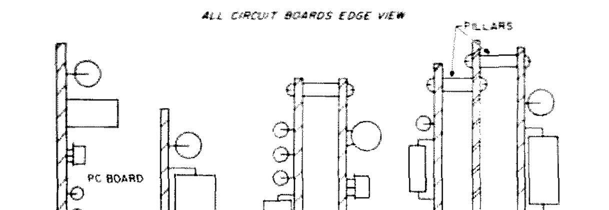


Fig. 8. Four methods of mounting circuit boards: PC-board sockets, L-brackets, double brackets, and shield plate.

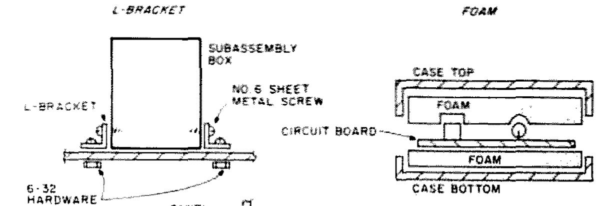


Fig. 9. Three methods of mounting subassemblies: L-brackets, panel nuts, and foam.

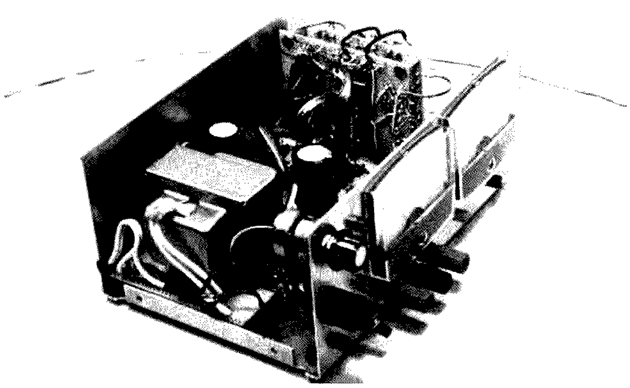


Photo G. Interior of a power supply showing two methods of circuit mounting: horizontal for heavy components and vertical for light control circuits.

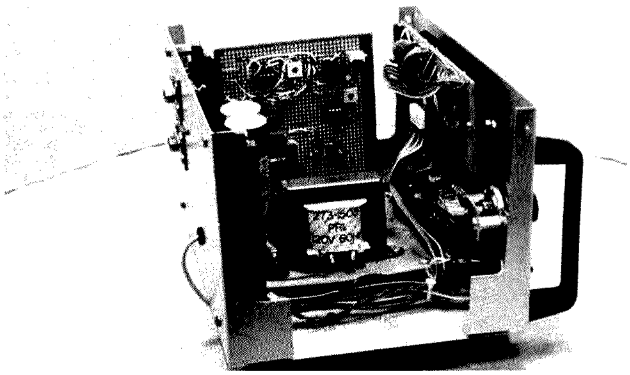


Photo H. A receiver filter using a combination of mounting methods: horizontal for the power supply, front-panel mount for a counter/readout circuit, and PC-board sockets for signal-processing circuits.

back wall of the case. The circuitry for this project, including the small power supply, was light enough not to stress the cabinet wall. However, it was heavy enough to require corner pillars rather than L-brackets. The back-wall position meant that there was no need to drill the bottom of the case. The position of the circuit makes removal for servicing or revision an easy matter. In addition, there is still room inside the case for circuit additions which might go on small boards vertically mounted to the cabinet bottom with L-brackets.

Photo G shows another combination of methods. The power components mount on a board supported by the cabinet bottom and pillars. The control circuitry mounts vertically at one end of the cabinet, with two boards back to back supported by four L-brackets. Each board dismounts independently for easy servicing. In Photo H, the still more complex receiver-filter project, we see even more methods at work. Again, the heavy power supply mounts horizontally in the middle of the case for weight balance. Against the front panel is a perfboard counter and LED circuit, mounted via standoffs to the threaded bezel mount. This system made a single unit out of an entire section of circuitry. The remaining circuits are on two experimenter boards that plug into PC card sockets mounted on pillars to the rear of the cabinet. (I removed one card to show the various subassemblies.) With this system, servicing and revising the circuits is simple. The plug-in cards pop out for work or to give roomy access to the remaining boards. The resulting project is still very open, allowing good air circulation and circuit isolation.

These illustrations do not exhaust the possibilities by any means. Rf circuitry, of course, will require more attention to shielding. This may lead you to construct subassemblies by soldering together pieces of double-sided copperclad board or to provide solid or perforated-aluminum covers for various parts of a project. Mechanical sensitivity may require the use of heavier materials for subassemblies, such as cast-aluminum boxes. In addition to the materials and hardware we usually associate with amateur radio, the world is full of things that may come in handy as insulating pillars, subassembly boxes, and a whole array of other helps around the shack. Among the items hams have used are cans (coffee, beer, and fish), plastic bottles, plastic parts from household items, bathroom products, packing materials, plumbing fixtures (both copper and plastic), and aluminum gutter. The possibilities are endless.

Providing a ham project with a cabinet and mounts is a task for both your imagination and your good sense. This article has looked at some of the good-sense basics of the matter. How much you improve upon them to make a better or more personal project is left to your imagination. ■

Rich Wurtzinger K9RLF
1140 S. Taylor Avenue
Oak Park IL 60304

Super Surplus Surprise

It's super: 50 Watts on 160, 80, 40, and 30 meters!
It's surplus: That means inexpensive!
It's the GRC-9: Still surprised?

The need for a low-cost rig for the new Novice—for Field Day or camping trips or just as a spare rig—has surfaced in the life of every ham. Here is an answer to all those needs and at a price you can't refuse!

The GRC-9 covers the upper portion of 160 meters, all of 80 and 40 meters, and the new 30-meter band. It will operate with almost any antenna you can conceive of. I haven't tried the proverbial bed springs, but they probably could be loaded up!

The rig will operate CW, MCW, and AM. The last two are sort of "who cares," but the CW is FB (up to 55 Watts input) with vfo or crystal, full break-in, high/low transmitter power, and receiver netting.

This rig was designed for the military for tactical communications over distances greater than can be covered by the usual handie-talkie or backpack FM gear commonly used. The manual specs up to 30 miles on ground wave. Now you show me a ham who works ground wave on 40 or 30 meters!

For ham use, it is really a CW rig, and not a bad one at that. It is complete in one package except for power supplies. The power input to transmitter will depend on the PA B-plus you use. The B-plus can be anything between 400 and 600 volts. The rig uses a 2E22 as a final. This is an instant-heating 807. The final is suppressor-grid modulated for AM and MCW.

The tube lineup for the transmitter is a 3A4 for vfo or crystal oscillator, a 3A4 doubler, and the 2E22 final. There is a vfo position and two crystal positions for each of the three ranges. There is also a 0C3 150-V regulator in the transmitter. It is used for both the transmitter and the receiver B-plus.

The receiver consists of a 1L4 rf, 1R5 mixer, 1L4 first i-f, 1R5 i-f/calibrator, 1S5 2nd detector first audio, 1R5 bfo, and a 3Q4 audio output.

The manual specs the receiver sensitivity at 2 microvolts for CW. I measured about 0.9 microvolts in the 80- and 40-meter bands for a 10-dB signal-to-noise ratio. The minimum detectable signal was approximately 0.15 microvolts (3-dB signal-to-noise ratio).

The receiver can be operated from batteries. The receiver requires a 90-volt B battery and 1.4 volts at 0.5 Amps; a no. 6 dry cell is recommended for the filaments.

I bought my rig from Fair Radio in Lima, Ohio, for a total of $60.00, which includes the rig ($39.95), the manual ($8.50), and the power connector ($4.00). The balance was UPS. The home-brew power supply I made came from the junk box, but Fair has a suitable power transformer and filter choke for about $10.00 total. The whole power supply shouldn't cost another $25.00. Now where can you get a 50-Watt, four-band CW portable(?) transceiver today for eighty-five bucks?

Photos by Chris Wurtzinger

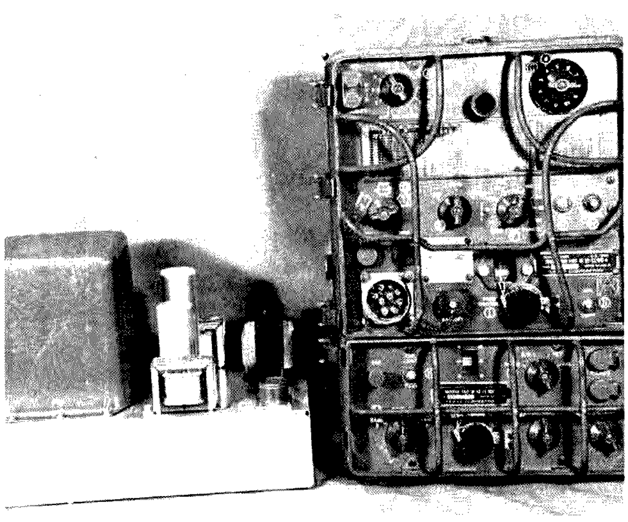


Photo A. The home-brew power supply is on the left. The GRC-9 is on the right.

Powering the Rig

The military had several power supplies for powering the rig. First was the P.P. 237 vibrator supply for 6-, 12-, and 24-V-dc input; similarly there is the DY88 supply which also runs off 6, 12, or 24 V dc. The DY105 runs only on 24 V dc. P.P. 327 is the 120-V-ac supply and the neatest of all is the GN58. The GN58 is a hand-cranked generator which will power the rig at somewhat reduced power out. This really goes over great with the jr. ops when they are pressed into service on Field Day. (Mine was actually disappointed when I didn't buy one!) Only the GN48 was listed as avail-

able in the Fair Radio catalog.

None of the reasonable power supplies is available, so I home-brewed one. The schematic in Fig. 1 shows how simple it is. The supply will provide power for 12-V-dc portable operation and 120-V-ac operation in the shack.

For portable operation, the 12 volts for the filament regulator and relay supply come direct from the battery. The plate supply is powered from a 12-V-dc-to-120-V-ac 60-Hz inverter. The requirements are about 100 Watts total from the inverter. There are a number of camping inverters which will fill the bill. Another possibility is one of the little gasoline-engine-driven generators to provide 120 V ac for all the power requirements.

The power supply is shown in Photo A, next to the rig. No special precautions in building it are needed. The power transformer and filter choke are available from Fair Radio. However, any power transformer giving 600 to 900 V ac center-tapped at 200 mA, 6.3 V ac at 3 Amps or more, and 5 V at 3 Amps will serve admirably. The choke should be 8 to 12 henrys at 150 mA.

Using the specified transformer and choke, the outputs will be: B-plus final, +560 V @ 100 mA; B-plus (send), +105 V @ 50 mA; B-plus (standby), +105 V @ 20 mA; filament transmitter, +6.3 V dc @ 2 Amps; filament receiver, +1.4 V dc @ 0.5 Amps; relay, +6.3 V @ 0.5 Amps. *Note:* Only one 105-V requirement is used at one time; never both at once.

The "send" rating is for when the transmitter is working and the "standby" is for when only the receiver is on.

Construction is straightforward. The only adjustments are the voltage-regulator current-limiting resistors.

Before turning power on with the rig, check the power supply alone. Set R1, R2, and R3 for maximum resistance. This is very important or you will blow the tube filaments or the 0C3. The relay output should be about 12 V dc, no load. The transmitter filaments should read 6.3 if R4 potentiometer is set right. If you don't read 6.3 on the transmitter filament line, set R4 for a 6.3-V-dc output.

Connect the power supply to the GRC-9 and turn the supply on. Then set the control E to Standby. Plug a pair of phones into the receiver phone jack. This turns the receiver on. Measure the 1.4-volt line and adjust R3 for 1.4 V dc on this line.

Then adjust R1 for 20 mA through R1 with control E still in Standby. Now turn control E to Send. Check the 6.3-V-dc transmitter-filament output to make sure it is still 6.3 V. If it is not, carefully adjust R4 for 6.3-V output. Check the 1.4-V output again. It should read 1.4 to 1.5 V in both the Send and Standby positions of control E. Still in the Send position, adjust R2 for 50 mA through R2. This completes the power-supply adjustments.

At this point, attaching an antenna to the rig should permit receiving the ham bands and the 5-, 6-, and 9.5-MHz shortwave broadcast bands. This brings us to the next and perhaps the most important point—the antenna.

Antennas

As I mentioned, the rig has a built-in antenna-matching network. The circuit will match an endfed half-wave longwire, a sixteen-to-twenty-foot whip, or a half-wave dipole.

For longwires, a full half-wave-long conductor is endfed by the matching network when control A is in the Reel position. This is the second-best antenna configuration to use with this set, the dipole/doublet being the best. With the rig driving the high-impedance point on the antenna, the antenna current is low (voltage at feedpoint is high, however) and the ground losses in a poor ground system will be minimized. Most ground systems that can be put together for portable work are usually poor because of relatively high resistance. When driving a low-Z antenna, the I^2R losses are high in the ground system, thus wasting power.

The Whip position permits using an antenna 16 to 20 feet long against a good ground.

As I noted before, a low-resistance ground is neces-

Specifications

- Frequency coverage 2–12 MHz in three bands:

Band 1— 2.0 MHz to 3.6 MHz
Band 2— 3.6 MHz to 6.6 MHz
Band 3— 6.6 MHz to 12.4 MHz

- Calibration marks are every 20 kHz on bands 1 and 2, and every 50 kHz on band 3 on the receiver dial and the transmitter calibration chart.

- **Frequency Stability**

Transmitter frequency stability is ±0.02% for supply variations of ±10%. Nominal final input is 50 Watts with a 560-volt supply. Receiver stability is not spec'd, but varying the receiver B supply ±10% on CW did not take the signal beat note out of the audible range.

- **Transmitter Power Output**

Transmitter power-output switch at High and Low positions:
Mil Spec (High) 15 Watts CW, 7 W AM
(Low) 5 Watts CW, 1 W AM
Measured at 3.7 and 7.1 MHz into a 50-Ohm load:
(High) 28 W CW, 16 W AM
(Low) 9 W CW, 4 W AM

- **Receiver**

Sensitivity:
Mil Spec 2 uV CW, 10 uV AM
for 10-dB signal-to-noise ratio
Measured 0.9 uV CW (7 MHz), 3 uV (7 MHz) AM
0.8 uV CW (3.7 MHz), 3 uV (3.7 MHz) AM

- **Bandwidth**

	Mil Spec	Measured
6 dB down	3.5 kHz maximum	2.9 kHz
20 dB down	12 kHz	10 kHz
60 dB down	30 kHz	23 kHz

- **Calibration Accuracy**

The mil spec calls out ± one calibration mark on any band. I never found more than two fiducial line widths of error in the ham bands. The receiver has a "netting" capability to permit setting the transmitter frequency exactly to the signal being received. There also are separate volume and rf-gain controls, a bandswitch, and a dial-light push-button for lighting the dial lamp when necessary.

- **Power Requirements**

Transmitter:
B+ (final) 400 to 600 V dc @ 100 mA
B+ (MO & X2) 105 V dc @ 50 mA
Filament: 6.3 V dc @ 2 Amps regulated
Relay: 6.3 V dc @ 0.5 Amps
Receiver:
13+ 90 to 150 V dc @ 18 mA
Filaments: 1.4 V @ 0.5 A
Output Power: 90 mW @ 10% distortion
Output Impedance: 250 Ohms or 4k Ohms

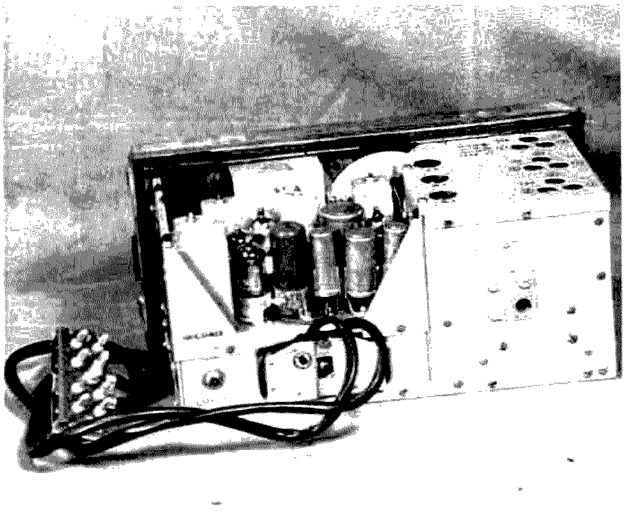


Photo B. Rear view of the receiver with tube shield off. Note output Z switch on left side of chassis.

sary for satisfactory operation with a whip antenna. I would recommend at least six 30-foot radials laid on the ground with the ends attached to one- or two-foot ground rods driven into as moist a soil as you can find.

In the Doublet position, the matching network is designed to match a 50-to-70-Ohm balanced load. A half-wave doublet has a center-driving impedance of 72 Ohms when the antenna is more than a quarter wave above the ground.

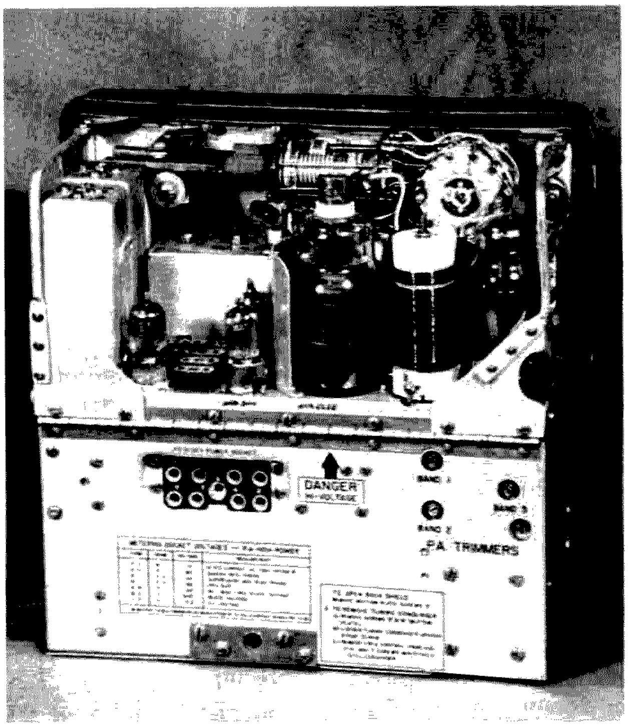


Photo C. Rear view of the transmitter showing location of crystal sockets. They are marked for band and A or B.

72-Ohm twin lead can be used as the transmission line, or RG-59 (75-Ohm coax) can be used. If coax is used, the shield should go to the terminal marked "doublet" and a jumper should be put between this terminal and the ground terminal on the receiver panel.

Whatever the type of antenna chosen, place control A on the highest number of that type. For instance, whip-antenna loading should start at Whip 4 and work down to Whip 1. The Reel position is actually for the longwires. Here you start at 8 and work down to 5, and finally for doublets, you start at 11 and work down to 9.

The procedure for tuning should be as follows. Assume a doublet is to be used.

Set control A to 11 and vary control C between 1 and 10, setting it for the brightest indication of indicator B. Make sure the red dots are matched on the indicator bezel.

When using the longwire, it may be difficult to get a good indication. In this case, disconnect the antenna and quickly tune the matching network for maximum glow of indicator B. Then reconnect the antenna. *Do not* keep the transmitter keyed more than 15 seconds under the no-antenna condition, or damage will occur to the 2E22.

If a multiband vertical is to be used with the rig, use the Doublet position with RG-58 or RG-8 and the shield connected to "doublet" and "ground" connectors.

The matching network will make up for minor variations in antenna length. Recommended antenna lengths for the ham bands are shown in Fig. 4.

Receiver Operation

The receiver functions when the power supply is turned on and when the transmitter switch, control E, is placed as follows:

A. *Standby Position*. The

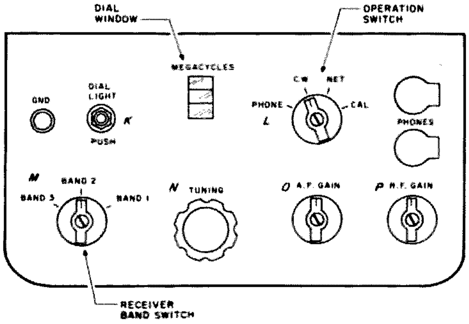


Fig. 1. Location and identification of receiver controls.

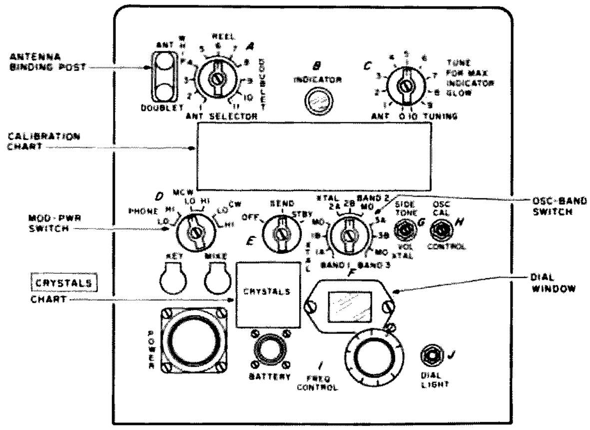


Fig. 2. Location and identification of transmitter controls.

Standby position is used when long periods of listening are required in order to reduce the wattage requirement from the power source.

B. *Send Position*. This position is used when the receiver is silenced and the transmitter is turned on when the key or the push-to-talk switch is pressed.

Preliminary starting procedure for receiver. Place operation switch control L as follows:

1) Phone. When receiving AM or MCW signals.

2) CW. When receiving CW signals.

3) Cal. When calibration of the receiver dial is desired.

4) Net. When aligning the transmitter frequency (control I) to the received signal for net operation. Also for aligning the MO (master oscillator) stage (control H) of the transmitter when the receiver dial is accurately calibrated.

Set bandswitch control M for the desired band of operation.

Turn af gain control O and rf gain control P to their maximum clockwise positions.

Turn on the switch of the power supply. Install the plug of the headset into the Phones jack of the receiver.

Prior to using the set, remove the receiver from the case and set the impedance switch located on the rear of the receiver section to the desired impedance, 250 Ohms or 4000 Ohms. Note: If the plug is not in the Phones jack, the filaments of the receiver tubes will not light.

C. Connect the antenna and a ground wire. Then set the antenna selector switch, control A on the transmitter, as shown in Fig. 5.

AM Reception.

Turn control L to Phone.

Turn control E on the transmitter to Send or Standby.

Turn controls O and P counterclockwise for a comfortable listening level in the headset.

CW Reception.

Turn control "L" to CW.

Tune for an audible beat note instead of a modulated signal. Adjust tuning for suitable beat note.

Receiver Calibration

This operation is used to check whether the dial reading for tuning control N actually gives the true frequency to which the receiver is tuned.

A 200-kHz crystal installed in the receiver supplies a series of crystal-controlled check frequencies against which to check the calibration of the receiver and transmitter. These check frequencies are all harmonics of 200 kHz. The calibration checkpoints are 2,000 kHz, 2,200 kHz, 2,400 kHz, and up to 12 MHz, thus covering the entire range of the radio set. To check the calibration of the receiver dial, proceed as follows:

1) Turn control L to Cal.

2) Turn control E on the transmitter to Standby.

3) Turn control D on the transmitter to Phone. In the Phone position, the filaments of all the transmitter tubes are not supplied with power and are inoperative unless the microphone push-button is pressed.

4) Turn af gain control O to the maximum or greatest clockwise position.

5) Turn rf gain control P to the maximum or greatest clockwise position.

6) Turn control M to band 3.

7) Turn tuning knob N to the lowest-frequency check (2.0 MHz). Adjust the tuning knob until zero beat is obtained on the strongest beat note in the vicinity of the crystal checkpoint. At this point, the dial should read close to the 2.0-MHz mark. Check in a similar fashion at a 200 kHz point near the desired receive frequency.

If interference from strong signals is being picked up during calibration, the antenna lead-in can be disconnected from the antenna binding post to avoid misleading beats.

Net Operation

The Net position of control L allows the transmitter to be tuned exactly to any frequency which the receiver is receiving. The Net position is used in conjunction with the transmitter when it is desired to place the transmitter in a group or net. To be sure that the transmitter is tuned to the same frequency as the receiver, proceed as follows:

1) Turn switch E to the Send position.

2) Receive the desired signal with the receiver tuning control L on CW.

3) Observe the frequency of the station and, referring to the transmitter-calibration chart, adjust the transmitter frequency control dial I to the approximate frequency.

4) Turn switch L on the receiver to the Net position.

5) Turn switch D on the transmitter to CW. Do not place switch D on Phone because it will be impossible to tune the transmitter to the receiver frequency.

6) Tune the transmitter frequency control I until the strongest beat note is heard in the headset.

7) Adjust frequency control I on the transmitter until a condition of zero beat is obtained.

Caution: During the entire process of tuning the transmitter to the receiver, do not press the key because this will cause the transmitter to have full output.

8) After the zero beat is found, lock the tuning

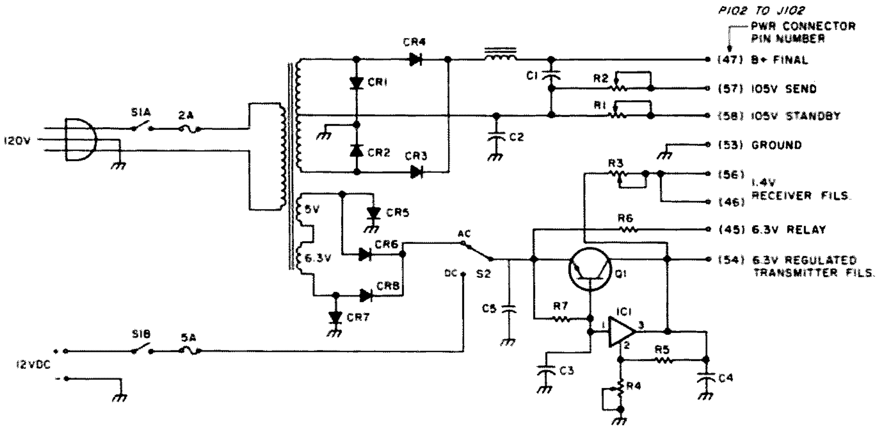


Fig. 3. Power-supply schematic.

knob of frequency control I.

9) Turn control D on the transmitter to CW.

10) Turn control L on the receiver to CW.

Transmitter Operation

The transmitter functions only when Off-Send-Standby control E (see Fig. 2) is in the Send position. When the key or microphone switch is closed, power is supplied to the transmitter and removed from the receiver.

Dial Reading. The tuning dial associated with frequency control I consists of two graduated scales. One is located behind a glass window and the other is marked around the edge of the tuning-control knob. The numbers on both of these scales are taken as one reading, and they determine the frequency to which the transmitter is tuned. The numbers are not the actual transmitting frequencies but are related to these frequencies by the calibration chart on the transmitter panel. *Do not operate* the transmitter without the antenna connected. Damage to power tube 2E22 will result.

Dial-Reading Calibration Chart. On the transmitter panel is a dial-reading calibration chart which relates the different frequencies of transmission to the dial settings. Each set must be tuned by the chart on its panel. Assume that it is desired to transmit on a frequency of 5,540 kHz in band 2; proceed as follows:

1) Find 5,500 kHz in the Freq. column of the band 2 section. Five columns, each with headings from +00 kHz to −80 kHz, follow this column.

2) Because the dial setting for 5,540 kHz is wanted, the +40-kHz column is the one referred to.

Band	Longwire	Doublet	Whip
160 m	240'	240'	20'
80 m	132'	132'	20'
40 m	65'	65'	20'
30 m	46'	46'	16'

Fig. 4. Recommended antenna lengths for the ham bands.

Control A Position	Ant. binding post connection	Gnd. Post
Whip 1, 2, 3, or 4	Ant.	Gnd.
Reel 5, 6, 7, or 8	Ant.	Gnd.
Doublet 9, 10, or 11	Ant. and Doublet	Not Used

Fig. 5. Antenna selector switch (control A) settings.

3) In the small box where lines through 5,500 kHz and +40 kHz intersect, the number 2284 is found. This is the number to which the dial should be set in order to transmit a frequency of 5,540 kHz—22 in the window and 84 on the knob skirt.

Vfo Operation

The oscillator section of the transmitter may be either crystal-controlled (Xtal position of control F) or a master oscillator (MO position of control F). The MO can tune over the entire band.

To transmit using the MO, proceed as follows:

1) Connect the antenna, key, microphone, power cable, and start-up set.

2) Set switch D to Phone, MCW, or CW, whichever type of transmission is desired.

3) Set control F to the MO position for the desired frequency band.

4) Release the lock on the frequency-control knob (control I). Turn control I to correspond with the transmitting frequency as shown on the calibration chart. If an unlisted frequency is used, interpolate to obtain the correct dial setting.

5) Turn antenna selector switch A to the highest numbered position for the type of antenna being used.

6) Turn the outer lens of indicator B until the red dot is adjacent to either red dot on the stationary lens.

7) Turn switch E to Send.

8) Turn control L on the receiver to Phone or CW position so that the sidetone can be heard.

9) Release the dial lock on antenna tuning control C. Press the button on the microphone, or close the key and rotate control C until indicator B glows at its maximum intensity. This indicates resonance or matching of the antenna to the transmitter.

10) If the indicator does not glow through a complete sweep of knob C, turn antenna selector knob A to the next lower number. Rotate knob C again until maximum glow is seen. If there is still no glow, repeat with knob A.

11) If the indicator glows with more than one setting of knob A, always use the highest-numbered position of this switch at which the indicator will glow. When using a longwire antenna, it is sometimes difficult to see any indication of resonance on indicator B when control C is tuned through resonance. In that case, temporarily remove the antenna lead from the antenna binding post and adjust control C to give maximum indicator glow, then reconnect the antenna lead and proceed with normal operation. When the antenna lead-in is reconnected, readjust control C for maximum brilliance, if necessary.

12) When the tuning procedure is completed, lock controls I and C in place.

13) Adjust sidetone volume control G for the desired volume level in the headset.

Transmitter Calibration

If it is desired to send a signal of approximately

3,800 kHz, set frequency control knob I at the appropriate setting as determined from the chart. When this setting is made, the calibration operation ensures that the transmitter will send a signal of 3,800 kHz. This is accomplished first by accurately calibrating the receiver, and then by feeding a reduced signal output of the transmitter into the receiver. The procedure is as follows:

1) Calibrate the receiver. The selected calibration frequency of the receiver must be a multiple of 200 kHz, which is closest to the desired signal output of the transmitter. Assume that a transmitter signal of 3,835 kHz is desired. The receiver should first be calibrated at 3,800 kHz because receiver calibration is accomplished by using the harmonics of a 200-kHz crystal.

2) Turn control F to MO for band 2.

3) From the transmitter calibration chart, determine the dial setting corresponding to the calibration-check frequency and turn frequency control knob I to that dial setting.

4) Turn control L on the receiver to the Net position.

5) Set control D on the transmitter to CW. Do not set it to Phone because calibration will be impossible in that position.

6) Turn control E to Send.

7) Turn af gain control O and rf gain control P on the receiver to their mid-position settings.

8) Adjust oscillator calibration control H on the transmitter with a screwdriver until a beat note heard in the headset stops and then starts again. The place where the silent point (zero beat) appears is where control H should be set. This corrects the calibration for that particular frequency, and all other frequencies within that band also will be correct.

9) To restore the receiver and transmitter to normal operation, turn control L to CW. Then set control I to the chart reading for 3,585 kHz.

Crystal Operation of Transmitter

To use crystals in the operation of the transmitter, the following procedure should be used:

1) Select operating frequency. *Note*: Crystal frequency is one-half operating frequency. Use only series-mode crystals.

2) Plug crystal into appropriate band sockets (band 1 for 40 and 30 meters, band 3 for 160 meters).

3) Look up operating frequency on calibration chart. Set frequency control I to the indicated dial reading.

4) Rotate control I above and below this setting while holding the key down and observe indicator B. The correct setting will correspond to the brightest glow of the indicator. Readjust control C again for maximum brightness of indicator.

The crystal-oscillator section of the transmitter may be checked for operation as follows:

1) Set receiver control L to Net.

2) Adjust the receiver to the transmitted frequency, rocking the receiver dial knob N slightly to both sides of the desired frequency while listening for a strong signal (beat note). If a beat note is not heard close to the expected frequency, the crystal is not operating.

Floobystones

After the first few contacts I started to ask how the rig really sounded on the air. Some reliable locals were worked and they critiqued the rig. The results were gratifying. The keying characteristics in the MO mode are quite good and no drift was measured over a half-hour operating time. All agreed that the rig is worth the money.

I look forward to the camping season when I can take the rig on weekend campouts.

Are there improvements I would like to make to the rig? Sure there are. First, I am building an active filter/amplifier module to improve receiver performance. The 3-kHz-receiver bandwidth is a little wide for good CW work. I am building a 600-Hz active filter which will be combined with a one-Watt audio amp to drive a speaker. This will help quite a bit. I have used these filters before and they really help things in a crowded CW band.

I am also looking at the possibility of making the first i-f regenerative and using it as a Q multiplier.

Considering the cost—$60.00 total—the conversion effort, building a power supply and cable, and the total time (about eight hours), this was one of the most successful surplus conversions I have ever made. I will be glad to answer any questions anyone may have if they write me at the address given and include a self-addressed stamped envelope.■

Power-Supply Parts List

R1	10k-Ohm, 10-Watt adjustable wire-wound resistor	(Newark, #13F539—$3.12 ea.)
R2	3k-Ohm, 10-Watt adjustable wire-wound resistor	(Newark, #13F530—2.80 ea)
R3	10-Ohm, 5-Watt adjustable wire-wound resistor	(Newark, #13F505—2.69 ea.)
R4	500-Ohm, 2.5-Watt potentiometer	(Newark, #27F1116—1.87 ea.)
R5	330-Ohm, ½-Watt, 10%, fixed carbon-composition resistor	(Radio Shack—.49 ea.)
R6	12-Ohm, 5-Watt fixed wire-wound resistor	(Newark, #13F147—1.27 ea.)
R7	39-Ohm, 1-Watt, 10%, fixed carbon composition resistor	(Radio Shack—.49 ea.)
R8	20k-Ohm, 10-Watt fixed wire-wound resistor	(Newark, #13F147—1.27 ea.)
R9	40k-Ohm, 20-Watt fixed wire-wound resistor	(Newark, #13F147—1.97 ea.)
T1	Power transformer 810 V ac c-t @ 220 mA, 6.3 V ac @ 3 A, 5 V ac @ 3 A	(Fair Radio, #3252—9.95 ea.)
C1, 2	80-uF, 450-V-dc electrolytic capacitor	(Newark, #18F235—5.40 ea.)
C3	0.1-uF, 50-V-dc ceramic capacitor	(Radio Shack—.37 ea.)
C4	2-uF, 15-V-dc electrolytic capacitor	(Newark, #15F073—.42 ea.)
C5	10,000-uF, 15-V-dc electrolytic capacitor	(Newark, #18F2446—5.73 ea.)
CH1	10-henry choke	(Fair Radio, #228-1859—3.25 ea.)
CR1, 2, 3, 4	1N4007 1000-V-piv @ 1-A diodes	(Newark, #IN4007—.55 ea.)
CR5, 6, 7, 8	MR850 50-V-piv @ 3-A diodes	(Newark, #MR850—.55 ea.)
Q1	MJ2955 PNP power transistor	(Newark, #MJ2955—1.06 ea.)
IC1	MC7805CK 5-volt IC regulator	(Newark, #MC7805CK—2.21 ea.)

Fair Radio Sales Co., Inc.
1016 E. Eureka Street, PO Box 1105
Lima OH 45802
(419)-223-2196

Newark Electronics
500 N. Pulaski Road
Chicago IL 60625

Cornelius C. Nouel KC5B
1445 W. St. Francis
Brownsville TX 78520

The Texas Trans-Tester

Here's how to measure small-signal gain with a transistor checker you've built from scratch.

One simple way that many of us use to test transistors is by means of an ohmmeter. Each junction is measured for forward and reverse resistance. These tests can detect if the junctions are open or shorted or if excessive leakage is occurring. In fact, it can be a useful check to identify the type of transistor, but it doesn't tell us much more.

I thought it would be nice to be able to measure transistor gain with a reasonable amount of certainty, so after reading up a bit on the subject I put together a little tester to measure the static beta, or h_{fe}—or what the experts call "the common-emitter static value of forward-current transfer ratio," or, more simply, the no-signal current gain of a grounded-emitter amplifier.

Despite the ominous sounding words, the required setup is very simple, as can be seen in Fig. 1. This did the job, but after a while I wanted something more accurate; the readings being obtained included the leakage current and therefore didn't tell me the real gain.

The schematic diagram in Fig. 2 shows what I finally worked out to measure the small-signal gain, or h_{fe}, also called the ac beta of the transistor. During this measurement, a collector current (which includes leakage current) is first established to simulate an operating condition, then the current is cancelled in the metering circuit and additional bias is applied; the meter now will show the current gain under those conditions.

A simple transistor checker.

Construction

The checker was built in a small plastic instrument cabinet (Radio Shack #270-222). There is absolutely nothing critical about the circuit. R1 is a 1-megohm linear pot to control or set the initial bias. R2 is a 2k-Ohm linear pot to zero the meter. Both these pots have switches, as shown in the diagram.

All the resistors are 1/4-Watt, 10 percent. Test switch SW3 is a normally-open push-on (Radio Shack #275-1547 or similar). For SW4, I used a common-variety DPDT slide switch (Radio Shack #275-407 or similar). The only expensive item is the meter. I happened to have a 1-7/8" × 1-5/8" 100-microamp size; I shunted it to measure 0-to-2 mA so that it would measure a maximum h_{fe} of 200. Some transistors may go out of scale, so a 0-3 or 0-4 might be a better choice. A more economical approach for those who have a multimeter might be to install a socket or binding post and use the outside meter.

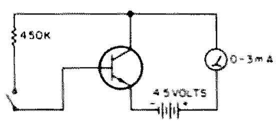


Fig. 1. Static beta measurement.

To power the tester, I use an ac adapter (Radio Shack #273-1454A) that provides 6 volts dc, but you could build your own power supply in the conventional way. Maybe a bigger cabinet can be used with a larger meter and a built-in power supply. Incidentally, I use the ac adapter to run a chess game when I am not checking transistors.

Using the Meter

Connect the transistor to the appropriate leads and set the slide switch to NPN or PNP, as the case may be, then turn SW1 on and set the meter to 1 mA. This is the initial bias. Now, turn SW2 on and with R2 set the meter to zero. To measure the h_{fe} gain, push the test switch. If the scale is in milliamps, multiply it by 100 to obtain the small signal current gain.

I have found this little

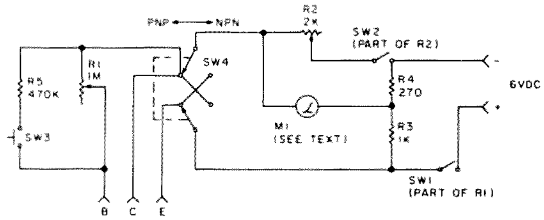


Fig. 2. Schematic diagram.

meter very useful, especially when trying to identify and evaluate hordes of transistors that have somehow found their way into my junk box. With the values shown, it will test or measure any small- or medium-signal bipolar transistor. It cannot be used to measure "power" transistors, although it will tell if they are still usable. It cannot tell up to what frequency the transistor will work, nor will it test FETs, JFETs, or MOSFETs, etc. For those tests, other circuits are required. ■

References

1. Solid State Servicing, RCA Institutes, Inc.
2. Transistor Manual, General Electric Company.

Parts List

R1	1-megohm linear potentiometer with switch
R2	2k linear potentiometer with switch
R3	1k, 1/4-Watt, 10% resistor
R4	270-Ohm, 1/4-Watt, 10% resistor
R5	470k-Ohm, 1/4-Watt, 10% resistor

See text for other parts.

✓ *See List of Advertisers on page 80*

BARTER 'N' BUY

Individual (noncommercial) .... 25¢ per word
Commercial .... 60¢ per word

Prepayment by check or money order is required with your ad. No discounts or commissions are available. Please make your payment to *73*. Rates for multiple insertions are available on request.

Advertising must pertain to amateur radio products or services. No special layouts or positions are possible. All advertising copy must be submitted typewritten (double-spaced) and must include full name and address. Copy limited to 100 words, maximum. Count only words in text. Address, free.

73 cannot verify advertising claims and cannot be held responsible for claims made by the advertiser. Liability will be limited to making any necessary corrections in the next available issue.

Copy must be received in Peterborough by the 5th of the second month preceding the cover date.

Send to Barter 'N' Buy, c/o Nancy Ciampa, Advertising Department, *73*, Elm Street, Peterborough NH 03458.

LETTERS

SUN ANGLE

In my October, 1984, article, "When Darkness Calls," I asked whether anyone had information on the significance of the "widely used figure" of −.75 degrees for the angle of the sun relative to the horizon at sunrise or sunset.

I have the answer now from EA3VY, who seems to know just about everything there is to know on the subject. It is very simple: When the tip of the sun is peeping over the horizon, the *center* of the sun is 50 minutes of arc below the horizon (about .75 of a degree in decimal terms).

So now I enter −.75 rather than 0.

Bob Eldridge VE7BS
Pemberton BC

JOHN Q. HAMS

With the increasing tendency over the past few years by local government towards more restrictive antenna ordinances, coupled with a largely apathetic amateur community, I thought it would be beneficial to share with you my recent experience. My story is one where my own city's amateur-radio emergency group took no effort to assist another amateur in battling a restrictive antenna ordinance.

I recently moved to the city of Irvine, California. The city has a 35-foot height restriction on external antennas, and there are no CC & Rs that prohibit external antennas. I wanted to install a 55-foot crank-up tower and antenna. Since the tower would be lowered to a height of 24 feet when not in use, it would be more aesthetically appealing than a 35-foot free-standing tower. Since my antenna would exceed the 35-foot height limit, I was required to obtain a Conditional Use Permit, something that the city had never granted a ham before me.

In addition to supplying the city with detailed engineering plans, site survey, plot plans, environmental assessment, letter of justification, and a mailing list of all property owners within 300 feet of my QTH, the city charged me a $300 filing fee and $44/hour to review my plans and prepare a staff report to the Planning Commission.

While my application was being processed, I sent out a 4-page letter to 270 licensed hams in Irvine, advising them of my problem and asking for their attendance at my public hearing. My letter mentioned that I would be stressing the public-service aspects of amateur radio in my presentation to the Planning Commission, because the Planning Commission had to determine that my proposal was in

accord with the public health, safety, and welfare for them to grant approval.

I provided every ham with an SASE and a reply note to send back stating whether or not they could attend, as well as stating their support for my proposal. I received 50 letters back, most of which indicated a willingness to support me and appear at my public hearing.

Interestingly enough, the City of Irvine has a group of over 50 amateur-radio operators that voluntarily assist the Public Safety and Police Department (Irvine Disaster and Emergency Communications). This group voluntarily provides their time and equipment to assist the Public Safety Department in times of emergency and public events. This group attends regular monthly meetings at police headquarters and receives training in first aid, emergency preparedness, damage assessment, etc.

I am also a member in good standing of this group. In fact, two months ago I was asked to make a presentation to this group on fast-scan ATV, highlighting its potential application for the IDEC group. This presentation was very well received, and Hugh Davis W6YBI and I were asked to assist in setting up this mode for the group.

Out of the 50 response letters I got back from the hams in Irvine, only two came from IDEC members. A week before my public hearing with the Planning Commission, IDEC had its regular monthly meeting. I mentioned to the group my disappointment in not hearing from more IDEC members, especially since we as a group were involved in directly benefiting the city, and our public-service accomplishments should not go unrecognized. Several board members and members at large indicated that they were in fact planning on attending, but simply forgot to send me their reply. It is important to note that at no time did I ever ask the IDEC group to take an official position in support of my antenna, but only as individual hams involved with public service and sharing a common bond.

The night of my public hearing came on November 1, 1984. My partners in IDEC did not even have one person from the group show up. Unbelievable! However, almost 50 other John Q. Hams not involved with IDEC rallied to the cause. We put on an excellent presentation to the Planning Commission that highlighted what amateur radio was, and its outstanding track record of public service on a local, state, and federal level. The Planning Commission also reviewed a petition signed by 55 of my neighbors in opposition to me, as well as many letters from neighbors expressing their concern about my antenna.

When it was all said and done, the Planning Commission gave unanimous approval to my application. An unprecedented victory for the hams in Irvine. Many of my opposing neighbors made comment at the public hearing of the excellent presentation we had made. Several said that they had no idea that ham radio was involved in so many fine public-service activities.

Where were the IDEC people? Irvine's own public-service ham group, individually and collectively, miserably failed to help a member and fellow ham in time of need. What an excellent opportunity to demonstrate a value and a worth to the community. Were they afraid that the Planning Commission might realize that the IDEC group represented ugly antennas in Irvine and cut off the city's limited financial support to the group?

What if the city were considering an ordinance to ban rubber duckies from Irvine—would they have gotten off their butts and taken a stand, or just run scared?

What if IDEC's closed and unfriendly 2-meter-repeater site was being threatened by a restrictive antenna ordinance—would they have taken a stand then?

My hats go off to the 50 or so plain old average hams in Irvine and the surrounding areas that took the time to help me and sell ham radio to the community. Many of those people just sat at the public hearing in silent support for me, representing the amateur community. Their presence had a positive impact. What a sad commentary, however, the IDEC group is on the future of ham radio. The future will continue to hold restrictive antenna ordinances and spectrum threats, while the majority of ham radio sits back and watches our hobby disappear.

Herb Rosenberg N6KJL
Irvine CA

TOO SIMPLISTIC

73 is one of the amateur-radio magazines which I enjoy for its technical articles, and I would rate it tops in that category over several other amateur magazines which I read. It also provides me with some needed humor in its editorial section.

The no-code clash seems to be one of the things, like the phoenix, that keeps rising from the ashes. The opinion that a no-code license would rescue amateur radio from some perceived doldrums gets a lot of press, and I see that even Japan is cited as one of the places where electrical geniuses were developed because of a no-code license. In the recent controversy in the US, Canada's no-code license was cursed and praised and neither side ever exhibited the faintest glimmer that they knew one thing about the no-code license here.

Citing the Japanese experience with a no-code license as some type of evidence that it will spur research is, at best, subject to great suspicion. The Japanese education system, the emphasis on commercial electronics as a professional field, and their cooperation between government and business in world market decisions contribute considerably more to their developments in electronics than a no-code license for a hobby. A no-code license has not brought about the type of electronic technology miracle that seems to be expected in Canada, not to mention the USSR, where a no-code license has been in effect for some time. If I can rely on some of my friends in the education administration in the US, the quality of teachers that are now coming into the field (which has had a decline in prestige and pay) will not enhance the electronics education of the US children.

In a technical sense, the type of communications envisioned by the no-code advocates would require that amateur-radio candidates should have to pass a test in computer programming in order to operate the gear to decode and encode all that high-tech, high-speed (and high-priced) equipment that we should be using.

If I went deer hunting with all the technical equipment for locating deer—laser sights and heaven knows what else, I suspect that most people would think that I should just buy a beef cow and provide meat without all the fuss. Amateur radio, like hunting, should not be an obsession rather than a hobby. Bluntly put, the commercial equipment now used for communication far exceeds the pocketbook of amateurs and is much more certain than the chance communication on the amateur bands. Amateur contribution to this field which operates on a very expensive

scale is not going to be much, despite what propagandists from the amateur community may say to the contrary. Trying to convince governments that we will make some significant contribution if the rules are changed will simply not work, because those changes will not produce the promised results. The fact remains that amateur radio is a hobby, and, like all hobbies, it is meant to be enjoyed rather than be used as a commercial experimentation expedition.

Whether or not there is a no-code license doesn't really concern me, to put it bluntly. However, my reaction to the advocates of no-code as a means of increasing members in the amateur-radio ranks and bringing about some technical revolution is one of great suspicion. If anyone thinks that a no-code license will bring about something that the educational, commercial, and professional systems have not brought about, their thinking is too simplistic to have any credence. In a world where simplistic solutions abound (like collectivization of farms solving the agricultural problem or sending more weapons bringing peace to Central America), another simplistic solution to a problem does not amuse me, and I am certain that I am not alone in this matter. In fact, if I could draw a nasty comparison, the no-code CB experience did not bring about any such revolution in electronic development, and I see no reason to believe that it will do so in the amateur ranks.

Undoubtedly, this letter will evoke some irate responses and to those who respond I put this question: Wouldn't basketball be more fun if the hoop was only two meters high? Wouldn't golf be great if the fairways were 50 meters long and the cups a meter wide? Wasn't CB fun? Would we get better basketball players and golfers, and the CB operators, not burdened by code requirements, should be whizzes compared to us strapped practitioners of the amateur-radio hobby. And, for that matter, if people have trouble with code and want the requirement dropped, then say so directly and don't beat around the bush. Saying that code is obsolete is like saying that bows and arrows are obsolete or that horses are obsolete or that radio is obsolete, for that matter. Of course they are. But they are still here, still used, and still enjoyed. Granted, the owner of Seattle Slew may be a bit offended if he found that his obsolete mode of transportation (for which he probably paid more for than a jet plane) could be beaten by any car on the road these days, but please . . . let him enjoy his hobby in peace, and let us enjoy our hobby in peace, too.

Finally, I enjoyed the comment about knowing ancient Hebrew to precede receiving a bible. My knowledge of Old Russian and reading of the documents from the 9th century in that area have given me a considerably better understanding of contemporary problems and, in fact, of the culture and mentality of the present Eastern European scene. It was a pain to learn, but it beats any translation, and the present translations are colored by the comments of the present political regime.

So, there it is . . . no-code or no no-code, who cares? But if you want more technicians, engineers, and other people in the electronics field, don't think that a no-code license is going to produce what lack of training, teaching, and financial inducements have now produced because, like Bismark so nicely put it, "Blessed are those who expect nothing, for they shall not be disappointed."

Francis Salter VE3MGY
London, Ontario

INVOLVED

I was twelve years old when I first learned about ham radio. I'm also female. I hear that I am a rare case. I finally got my license when I was 18 (two years ago). No one in my family is or ever has been a ham. I was different than the others when I was growing up. I liked radios and electronics (still do) and am now working toward my electronics degree.

I'm a new ham, but I don't have much money. A friend got a repeater set up on 220 MHz and I got some money together to buy a 220 radio, but now they're going to take the band away because no-code did not make it.

If I knew what was really going on instead of listening to the old-timers that swear by Morse code, I would have fought for no-code, like some other hams I know who weren't blinded by the old-timers. I am sure there are some other beneficial things that we fight against because we don't know the truth. We've got to learn the truth before it is too late. I hope it isn't too late.

Hams, myself included, are killing amateur radio. We must stop. We must work with the FCC. It can't be too late. I'm a young ham and I want to have the opportunity to enjoy amateur radio as you did—to learn and grow from it.

I would like to help save ham radio. I'm sure most hams would. Kids nowadays are interested, but they need a little push. If they *are* enthused and interested, most hams don't really help them. Example: A kid about 12-14 years old is watching a neighbor (Mr. Smith) who is a big ham operator. The kid is obviously interested, so Mr. Smith says, "Are you interested in all this?" The kid busts out a smiling, "Yes." "Well, if you want to get your license," Smith says, "all you have to do (pulling out a Novice book and a piece of paper with the code on it) is to study this book and learn the Morse code on this paper." He hands the kid the book and the paper. From then on, the kid is on his own until the kid is ready for his test.

Mr. Smith should have gotten *involved*—helped the kid with the code, practiced with him, and maybe even bought him a cheap code practice oscillator. I mean, if he can afford all that radio equipment, he can afford that. He should give the kid some of this time, help him become a ham, and teach him what amateur radio can mean to him. To leave the kid on his own with a book and a copy of the code is no help at all.

Make an effort for the kid, for yourself, and for amateur radio. It's up to us to keep it alive. Let's show the FCC that we still care and that we appreciate them for what they have done. We have to stop fighting. We have to come toghether and fight to put amateur radio back on its feet and make it what it was meant to be.

Karen A. Cooley KA6TRP
Sacramento CA

Karen—Thanks for the nice letter—you have a helpful suggestion for the old-timers. I sure appreciate your interest—particularly since you're a woman—we have all too few women in amateur radio who have a real interest in the technical end of things.—Wayne.

SUPERSTITIONS

Living in a community that does not allow outdoor antennas or even antennas disguised as flagpoles, I am always intrigued by solutions that provide some degree of radiating efficiencies particularly on the HF bands.

I don't have any magic solution, but getting away from the typical ham folklore and superstitions is a beginning to making the best of a bad situation. Discussions in the October, 1984, issue on the "Isotron" prompted this letter, but I'd like to cover a little more ground than that.

I don't know the "Isotron," but I know its physical dimensions from the discussion. As a trained professional in matters of physics, I immediately knew that its radiation resistance is quite low, which is not necessarily fatal, so I read on, looking for its bandwidth. As it turns out, its bandwidth was quoted as covering the band. That is bad in terms of radiating efficiencies. An efficient small antenna (compared to wavelength) must have a *small* bandwidth that decreases rapidly with decreasing physical size.

Here are some more useful things to remember about antennas in physically restricted space. Many of these ground rules go against conventional "ham" wisdom:

1) Make them as large as possible (to keep radiation resistance high). Loading coils do not count, they are just matching devices. If the vswr bandwidth is low, rejoice. Use a large-diameter cable to feed it. If the vswr is 5:1 at the band edge through the cable, rejoice again: You are probably not losing much power in the cable. If you want to know how efficient your cable is, measure vswr at the antenna and again at

the cable input. No *change* in vswr means no cable loss. Now use a good (physically large, to get high Q) tuner.

2) If you want to compare two antennas, you don't have to go on the air. You will be better off not to. Just make sure both antennas are matched to roughly the same impedance. The antenna that receives better will also be heard better, *always*. This is a result of the linear bilateral nature of a communications circuit. The difficulty with "on the air" comparisons is that the two antennas are usually in two separate locations or have different patterns resulting in different fading cycles. In order to get a good evaluation of the difference, it takes more than one or two switchovers.

3) There is no such thing as "capture area" of an antenna as distinct from its performance in the radiating mode. An antenna system's performance is uniquely described by its gain over a reference radiator (dipole or isotropic). Unfortunately, physically small antennas of 1/8 to 1/20 of a wavelength such as are used for mobile or restricted-space service will have losses between 3 and 20 dB, depending primarily on length and secondarily on Q. Anything smaller will have even greater losses.

Peter Laakmann WB6IOM
Laguna Niguel CA

SPECIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices, 73 Magazine, Pine St., Peterborough NH 03458.

HOUGHTON MI
JAN 29-FEB 5

The Michigan Technological University Amateur Radio Club and the Copper Country Radio Amateur Association announces a radio celebration of our winter carnival festivities in the northernmost part of Michigan's Upper Peninsula. A certificate will be issued to all amateurs who make one contact with any participating ham in Copper Country between 0000 UTC January 29, 1985, and 0000 UTC February 5, 1985. Frequencies are 3.630, 7.090, and 14.095 RTTY; 3.705, 7.085, 7.125, 14.085, 21.085, and 28.185 CW; 3.930, 7.285, 14.305, 21.385, and 28.500 phone. (On CW, listen for CQ WC.) Send your QSL and $1.00 to cover postage and handling to Howard Junkin N8FHF, 106 W. South Avenue, Houghton MI 49931.

TRAVERSE CITY MI
FEB 9

The Cherryland Amateur Radio Club will hold its twelfth annual Swap 'N' Shop on February 9, 1985, from 9:00 am to 2:30 pm, at the Immaculate Conception Middle School gymnasium, 218 Vine Street, Traverse City MI. Admission is $2.50 and single tables are $3.00. Talk-in on 146.85 and 146.52 simplex. For further information, send an SASE to Paul Nepote KA8HIB, Chairman, 802 Fern Street, Traverse City MI 49684.

INVERNESS FL
FEB 9

The Sky High Amateur Radio Club will sponsor the Citrus County Hamfest on February 9, 1985, from 9:00 am to 5:00 pm, in the Citrus County Auditorium, 1 mile due south of Inverness FL on US 41. The ticket donation is $1.50 in advance and $2.50 at the door. Tables are $5.00. Talk-in on 146.355/.955 (W4IIR). For tickets, tables, or more information, contact SHARC, PO Box 2543, Homosassa Springs FL 32647.

MANSFIELD OH
FEB 10

The 24th annual Mansfield Midwinter Hamfest/Auction will be held on Sunday, February 10, 1985, beginning at 8:00 am, at the Richland County Fairgrounds, Mansfield OH. Tickets are $3.00 in advance and $4.00 at the door. Tables are $5.00 in advance and $6.00 at the door. Half tables are available. There will be an auction and flea market in large, modern, heated buildings. An ARRL/VEC license exam will be held at the Mansfield Campus of the Ohio State University/North Central Technical College (less than two miles from the hamfest) at 1:00 pm on the day of the hamfest. To take the exam, send an SASE, a 610 form, and a check for $4.00 payable to ARRL/VEC to Lloyd Nelson N8BAZ, 630 Oak Street, Lot 82, Mansfield OH 44907. Talk-in on 146.34/.94. For additional information or advance tickets or tables, send an SASE to Dean Wrasse KB8MG, 1094 Beal Road, Mansfield OH 44905, or phone (419)-589-2415.

ARLINGTON TX
FEB 16

The Texas VHF-FM Society will hold its annual winter convention, Wintercom' 85, on February 16, 1985, at the Charlie Club, 117 South Watson Rd., Arlington, Texas (between Dallas and Fort Worth). The proposed 20-kHz band plan for two meters will be decided at the convention. Also on the agenda are emergency communications by packet radio, common antenna systems, AMSAT, ATV, and 20-kHz repeater channel spacing. Tickets are $7.00 at the door. Hardin Electronics will move their "third Saturday flea market" to the convention (indoors). For further information, write Wintercom' 85, PO Box 3608, Arlington TX 76101-0408.

MARLBORO MA
FEB 17

The Algonquin ARC will hold its annual electronics flea market on February 17, 1985, at Marlboro Junior High School Cafeteria. Doors will open for sellers' setups at 8:30 am and to the public at 10:00 am. General admission is $1.00, sellers' tables are $7.50 in advance (before February 9th) and $10.00 at the door. Food will be available. Talk-in on .01/.61 and .52. For table reservations or more information, write to AARC, PO Box 258, Marlboro MA 01752.

MELVILLE NY
FEB 17

The Long Island Mobile Amateur Radio Club (LIMARC) will hold an ARRL-sponsored hamfest on Sunday, February 17, 1985, from 9:00 am to 4:00 pm, at the Electrician's Hall, 41 Pine Lawn Road, Melville NY (1/4 mile east and 1/10th mile north of Exit 49 of the Long Island Expressway). General admission is $3.00 per person (no exceptions); unfortunately, table space has been sold out. Features will include a VHF checkup clinic, food, refreshments, and free parking at the hall and alongside LIE. Talk-in on 146.25/.85. For more information, contact Hank Wener WB2ALW at (516)-484-4322, nights only.

GLASGOW KY
FEB 23

The annual Glasgow Swapfest will be held on Saturday, February 23, 1985, beginning at 8:00 am CST, at the Glasgow Flea Market Building, 2 miles south of Glasgow, just off Highway 31E. Admission is $2.00 per person and there is no additional charge for exhibitors. The first table per exhibitor will be free, and extra tables will be available for $3.00 each. There will be a large heated building, free parking, free coffee, and a large flea market. Talk-in on 146.34/.94 (primary) or 147.63/.03 (alternate). For additional information, write Mike Goad N4HCO, Rt. #4, Box 354, Glasgow KY 42141.

FRIDLEY MN
FEB 23

The Robbinsdale Amateur Radio Club will hold the 4th annual Midwinter Madness Hobby Electronics Show on Febru-

✓ See List of Advertisers on page 80

ary 23, 1985, at Totino-Grace High School, 1350 Gardena Avenue NE, Fridley MN (suburb of Minneapolis). Admission is $4.00 at the door. The flea market will be open at 8:00 am and the retail exhibits will open from 9:00 am until 2:00 pm. Features will include manufacturers, dealers, and a flea market consisting of radio, computer, and satellite-TV gear. All FCC amateur-radio tests will be given. For more details, write Elmo Nygard, 4151 Adair Avenue N., Robbinsdale MN 55422. Talk-in on 147.60/.00 (K0LTC repeater) and 146.52 simplex. For more information, contact Robbinsdale ARC, PO Box 22613, Robbinsdale MN 55422, or call Bob at (612)-533-7354.

SALEM OR
FEB 23

The 1985 Salem Mini-Hamfair will be held on February 23, 1985, beginning at 9:00 am, at the Polk County Fairgrounds. Admission is $4.00. Now in its fifth season, the one-day event will feature seminars, commercial displays, amateur license exams, and a large flea market (setups begin at 8:00 am). Talk-in on 146.26/.86 and 146.52 MHz. For further information, contact Salem Repeater Association, PO Box 784, Salem OR 97308.

LIVONIA MI
FEB 24

The Livonia Amateur Radio Club will hold its 15th annual LARC Swap 'n' Shop on Sunday, February 24, 1985, from 8:00 am to 4:00 pm, at Churchill High School in Livonia MI. There will be plenty of tables, refreshments, and free parking. Reserved table space (12-foot minimum) is available. Talk-in on 144.75/5.35 and .52. For further information, send an SASE (4" × 9") to Neil Coffin WA8GWL, c/o the Livonia Amateur Radio Club, PO Box 2111, Livonia MI 48151.

DAVENPORT IA
FEB 24

The Davenport Radio Amateur Club will hold its 14th annual hamfest on Sunday, February 24, 1985, from 8:00 am to 4:00 pm, at the Davenport Masonic Temple, Highway 61 (Brady Street) and 7th, Davenport IA. Tickets are $2.00 in advance and $3.00 at the door. Tables are $7.00 each and for an ac hookup, an additional $2.00 will be charged. Talk-in on 146.28/.88 (W0BXR repeater). For table reservations and advance tickets, contact Dave Johannsen WB0FBP, 2131 Myrtle Street, Davenport IA 52804.

VIENNA VA
FEB 24

The Vienna Wireless Society will hold its annual Winterfest™ on Sunday, February 24, 1985, beginning at 8:00 am, at the Vienna Community Center, 120 Cherry Street, Vienna VA. Admission is $4.00. Coffee and food will be available all day. Talk-in on 146.31/.91 (NVFMA), 146.085/.685 (VWS), and 147.51 simplex. For vendor and tailgate applications, send an SASE to Earl Hohbein N4FSW, 4602 Lawn Court, Fairfax VA 22032. For further information, write to the Vienna Wireless Society, PO Box 418, Vienna VA 22180.

LAPORTE IN
FEB 24

The LaPorte ARC will hold its winter hamfest on Sunday, February 24, 1985, at the LaPorte Civic Auditorium, LaPorte IN (50 miles SE of Chicago). Donations are $2.50 each at the gate. Tables are $2.00 in advance and $2.50 at the door. (Reservations will be held until 8:30 CST.) There will be good food and plenty of room. Talk-in on .52 simplex. For more information and reservations, contact LARC, PO Box 30, LaPorte IN 46350.

BLACKSBURG VA
MAR 14-16

Virginia Polytechnic Institute and State University will hold a workshop, Personal Computer and STD Computer Interfacing for Scientific Instrument Automation, on March 14-16, 1985, at Virginia Tech, Blacksburg VA. The hands-on workshop, directed by Mr. David E. Larsen and Dr. Paul E. Field, is $450.00 for three days. Participants will be wiring and testing interfaces. For more information, write Dr. Linda Leffel, CEC, Virginia Tech, Blacksburg VA 24061, or phone (703)-961-4848.

150TH ANNIVERSARY
SPECIAL EVENT
VICTORIA, AUSTRALIA

A special commemorative callsign, VI3WI, part of the 150th anniversary celebration of the European settlement in Victoria, will be on the DX bands until at least April 30, 1985. VI3WI will be activated on a roster basis by selected members of the Wireless Institute of Australia and its affiliated clubs. All DX bands and all modes will be used and a commemorative QSL is available, either direct or via the VK3 QSL Bureau. A special award certificate is also available for radio contact with Victoria between November, 1984, and April 30, 1985. Contact (SWLs log) one station in VK3 during the award period to qualify. A QSL card for the qualifying contact, endorsed with a congratulatory message on Victoria's 150th anniversary, plus $2.00 or equivalent, should be sent to Victoria 150 Award, Wireless Institute of Australia, 412 Brunswick Street, Fitzroy 3065, Victoria, Australia.

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

from page 6

Even the Boy Scouts have dumped the code.

The sound defeat of the no-code proposal before the FCC last year by the ARRL yes-men ham clubs could be the beginning of the end for our great hobby. As it said in the article, "most of the students look upon it as a form of punishment" according to a teacher at a Navy school which still teaches a few people the code each year. Very few.

Once the FCC has acted on a proposal, it is difficult to get them to ever go back and reconsider it again. But look, if you will write a petition to the FCC recommending reconsideration of the no-code proposals—or even better, pass a petition around your ham club and at hamfests asking the FCC to reconsider—it's possible that we may get them to work with us again. Yes, I know they're absolutely disgusted with us for fighting progress and being so reactionary. They're rightfully furious with us for sealing our own doom. But this is a democracy, so no matter how much they think we're wrong, they've gone along with what you forced the ARRL to recommend and killed no-code.

If you will, please send me a copy of your petition so I'll be able to take it to Washington and make sure that every one of the FCC Commissioners sees it personally.

It's simple to petition the FCC. You write a letter in your own words asking for the reconsideration of the no-code amateur-radio license. You sign the letter, have it notarized, and send it to the Secretary, FCC, Washington DC 20554—and don't forget a copy to Wayne Green W2NSD/1, 202N, Peterborough NH 03458.

And don't forget March 24th—Ham-Day!

HAM HELP

I am looking for information on the use and modification of the General Radio 1606 rf impedance bridge.

George Churpek N6FL
839 Cambon Circle
Ojai CA 93203

Does anyone know of a modification that can be made to the Kenwood TR-7500 that will enable it to be used on the entire 2-meter amateur band? Any help will be appreciated, and I will pay any copying costs involved.

Dave Stepnowski KC3AM
735 W. Birchtree Lane
Claymont DE 19703

I need a copy of the schematic and manual for an EICO model 460 oscilloscope. I will gladly pay copying and postage costs.

Norman L. Duff
1505 South 25th St.
Lincoln NE 68502

Our small repeater group is in need of information on the Phelps-Dodge Super Stationmaster antenna (142-151 MHz). Specs and adjustment information is needed. Will pay costs and postage.

Lincoln County Repeater Group
R. L. Fredrick W7KCP
Box 154
Reardan WA 99029

Would someone please help me find schematics or information on how to obtain a remote-keyboard control for the ICOM 720A? I will gladly pay for any costs incurred.

Werner Heyen DL5BBD
Isdobben 3
2972 Borkum
West Germany

I need a schematic diagram for the Sinclair ZX-80. I will gladly pay for postage and copying.

Brian Iehl KA9MOE
4213 N. Ridgeway
Chicago IL 60618

Does anybody have information on how to build a ferrite-bead antenna?

Marvin Rosen N3BQA
20 W. Madison Street
Baltimore MD 21201
(301)-665-6308

Does anyone have the mailing address for Communications Company in Coral Gables, Florida? There is no listing for them in the current phone book. I have one of their 450-MHz repeaters and want to obtain schematics. Can anyone help with an address or, better yet, schematics I may copy?

Terry Simonds WB4FXD
PO Box 1558
Edgartown MA 02539

I would like to get in touch with DX stations interested in participating in a propagation study during the low end of the sunspot cycle by operating a CW beacon on 10, 21, or 28 MHz.

John Mahagan WB4JHS
PO Box 3282
Thomasville GA 31799

I need a manual, schematic, or calibration information for a Radiokit Arkay model 012 VTVM, and a manual or schematic for an Electronic Measurements Corp. model 101B VOM. I will gladly pay any copying and postage costs.

Robert Saltiel N2ETL
2190 Boston Rd.
Bronx NY 10462

HAM HELP

I need to get the Lafayette Variac (variable voltage control), new or used, number 99-60287 or similar, output from 0 to 140 V, 50/60 Hz, 500 W or higher, 117 VAC.

Mr. Salles
141 NE 3rd Ave. Suite 1110
Miami FL 33132

I am trying to locate a schematic or info on a Bullet 16-Amp, 12-volt power supply. Also, I am trying to locate Jerrold QDMX tower sections 6, 7, 8, and base stubs. Any info is appreciated.

P. E. "Packy" Pickrell AE3O
5026 Sidney Rd.
Mt. Airy MD 21771
(301)-831-5501

I am a high school student and would appreciate any donation of amateur radio equipment, working or not.

Mark A. James KB4FFC
6151 22 Ave. SW
Naples FL 33999
(813)-455-1385

I have an SBE SSTV rig that is ill—it needs a uA7090. Can anyone help?

R. F. Bricker K4CSV
PO Box 295
Fort White FL 32038

I am compiling data on VHF/UHF rf chokes. Can anyone send info on the Ohmite Z-235 and Z-460, or the Miller RFC-220 and RFC-420? I need the following: approximate wire size, length of winding, approximate number of turns, and the outer diameter of the form.

G. C. La Grange W5AKQ
318 E. Circle Drive
Baytown TX 77521

Does anyone know the wire lengths required for the Savoy-Bassett vacuum-trap antenna system, model DGA-4075, for 40 and 75 meters?

Ladd W2KGV
787 Lomas St.
Port St. Lucie FL 33452

I'm looking for information on the Realistic DX-302 shortwave receiver imported by Radio Shack in 1982. Does anyone know of a source for this radio? A used one would be suitable.

Sgt. Neal Roberts
11912 Amerado Blvd.
Omaha NE 68123

I need the schematic and manual for the Conar model 452 2-meter radio that was supplied with the old NRI ham-radio course. I will gladly pay any reasonable cost incurred.

Tom Ciciora KA9QPN
321 Pulaski Rd.
Calumet City IL 60409

I need help with a Redi Kilowatt model 401 electronic memory keyer. Either schematics, service info, or present location of the manufacturer. Glad to pay.

D. W. Langston W5BBV
PO Box 890
Salem AR72578

I need schematics and data for the Synthacoder 22S and the AED scanner for the IC-22S. I will copy these and reimburse your postage.

Bob Miller KC2VP
15 Crestwood Drive
Clifton Park NY 12065

✓ *See List of Advertisers on page 80*

NEW PRODUCTS

COMMUNICATIONS DISCOUNT DIRECTORY

A new directory designed to help consumers buy communications equipment at the best possible prices has just been published by Di$count America Publications. *The Directory of Communications Equipment Discounters* lists mail-order companies that offer savings of up to 50% on video equipment, telephones, cameras, ham radios, televisions, copiers, and movie paraphernalia. For each listed company the address, telephone number, shipping policy, catalog cost (most are free), and payment methods are given, along with a paragraph describing what goods the firm sells plus samples of prices and discounts.

For further details, contact *Di$count America Publications, 51 East 42nd St., Room 417T, New York NY 10017.* Reader Service number 482.

HIDDEN TV SIGNALS

Universal Electronics announces their new book for the satellite trade. "The Hidden Signals on Satellite TV" is the first book that completely covers the entire field of non-video satellite services carried on the domestic satellites.

These services include: stereo subcarriers, telephone channels, world news and press services, Teletext and other VBI systems, single-channel-per-carrier (SCPC) systems, plus other data systems.

"Hidden Signals" deals with all phases of this expanding side of the satellite business: the systems, how they work, who uses them, how they are received, and how the services can be utilized. The entire book is devoted to this area, and will enable a person to thoroughly understand the latest developments and put this knowledge to use.

The 180-page book is straightforward, easy to read and to understand, and contains many diagrams, photos, and other pertinent information.

For additional information, write or call *Universal Electronics, Inc., 4555 Groves Rd., Suite 3A, Columbus OH 43232; (614)-866-4605.* Reader Service number 481.

DATALOG SOFTWARE

dataLOG Software announces the release of their Amateur Radio Logbook program for the TRS-80 Color Computer, the first in a series of ham-radio software to be released by dataLOG. It uses database-type record keeping to store up to 1550 QSOs in a two-drive system, or 900 in a one-drive system. It features a 24-hour software clock that automatically logs in the time when you enter a call.

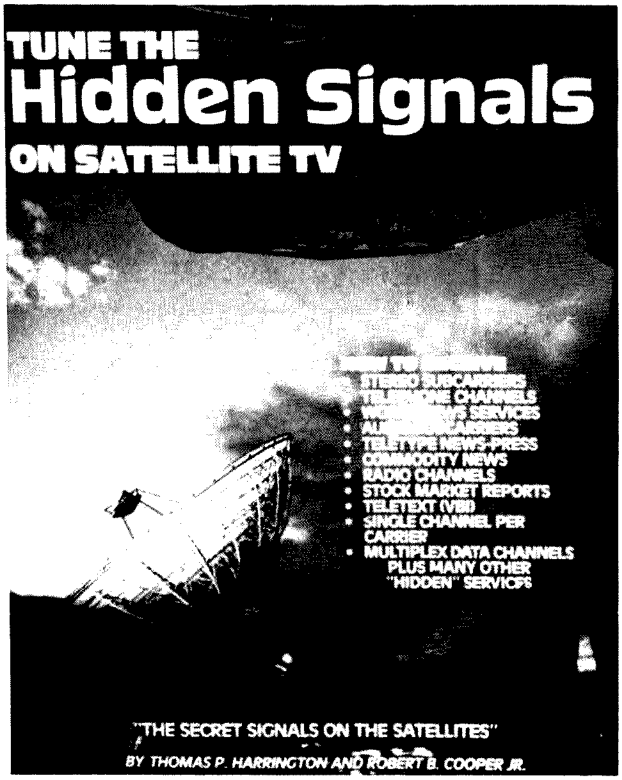
The date, band, and mode of transmission can be logged in automatically or manually. After entering a call, the log is quickly scanned for any previous contacts with the station and, if any are found, the screen is updated with name, QTH, date, and band on which the last QSO was made.

The printout portion of the program allows you to search and print by date, call, prefix, or print the entire log. You may also choose alphasort and print all, stateside, or DX contacts in alphanumeric order.

An additional program, dataLOG/DXCC, is available that works in conjunction with the log program. The DXCC program produces a printout by country and prefix, listing each contact made with the country, the date and band, and the QSL status.

For additional information, please contact *dataLOG Software, PO Box 10531, Jacksonville FL 32247; (904)-398-7933.* Reader Service number 490.

dataLOG software in action.



Satellite secrets are revealed in Universal Electronics' book.

SI-160 FREQUENCY SYNTHESIZER

The SI-160 frequency synthesizer is the latest in a series of laboratory instruments announced by Syntest Corporation. The SI-160 is an advanced 5-digit synthesizer providing ECL signals into a 50-Ohm load over the range of 20 to 160 MHz, with a resolution of 1 kHz.

Utilizing all solid-state circuitry and employing a single, phase-locked loop, this instrument provides high performance and high reliability at low cost. Temperature stability is guaranteed to ±1 ppm over the temperature range of 0-50° C.

This laboratory instrument will find applications wherever a stable, low-noise, selectable-frequency, high-reliability signal source is required. Typical applications include: plotting and alignment of active and passive filters, as a calibration standard for standard analog oscillators, a standard frequency source for AM and FM transmitters in the VHF band, and to provide a low phase-noise source for microwave oscillator stabilization.

For additional information, contact *Syntest, 40 Locke Drive, Marlboro MA 01752.* Reader Service number 483.

THREE FROM MIDIAN

Midian Electronics has recently introduced three new products aimed at the communications market.

The TCS-2 tunable CTCSS encoder/decoder is compatible with most commercial subaudible-tone squelch systems. It is field-tunable from 60 Hz to 250 Hz, has an adjustable audio output level, and features a wide input dynamic range.

Midian's VPU-2 tunable voice scrambler includes an anti-aliasing input filter, a six-pole tracking output filter, and is capable of simplex operation. The unit fits into most portable, mobile, and base stations, and is compatible with fixed frequency-inversion scramblers.

The TTD-4A is a subminiature DIP-switch programmable touchtone™ decoder. Features include: group and all

Syntest's SI-160 frequency synthesizer.

call, 2400-Hz ring tone, horn output, latching call light, and positive or negative squelch output.

For further information about these products, write *Midian Electronics, 2302 East 22nd Street, Tucson AZ 85713.* Reader Service number 489.

TWIN OAKS CW TRAINER

Twin Oaks Associates has announced a new computerized Morse-code ear-training program which is compatible with the Apple II family of personal home computers. Features include: programmed learning with behavior modification, automated or user-selectable menus, variable speed and pitch, automatic grading of student performance, and interactive routines.

C.W. Tutorsoft teaches character, word, callsign, and QSO phrase recognition. It does this through an interrelated series of passive and active learning experiences. This program was designed and tested by experienced hams who are also mental health professionals. It applies classical learning theory and modern behavioral modification to guide students to a thorough, practical, and effective understanding of the Morse code.

C.W. Tutorsoft allows people who have no prior training in, or knowledge of, CW to train themselves; those already having some code ability, who seek greater proficiency, will also benefit from working with this new program. It's helpful in the classroom, too.

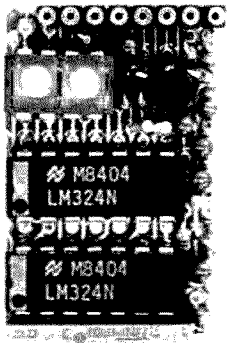
C.W. Tutorsoft is available from *Twin Oaks Associates, Route 5 Box 37, Knoxville IA 50138.* Reader Service number 486.

NEMAL CABLES

Nemal Electronics International of North Miami, Florida, has introduced a new line of direct-burial actuator cable for satellite earth station and communications applications. Each type provides the proper cabling for both motor power and sensor/control in a single polyethylene jacket suitable for direct burial.

Nemal ST-1 consists of 2 conductors of 16 gauge and 2 conductors of 22 gauge with foil shield and drain wire. Nemal ST-2 contains 2 conductors of 12 gauge and 3 conductors of 22 gauge with foil shield and drain wire. Nemal also offers a line of five types of satellite control cables which contain motor, sensor, polarotor, and coaxial signal lines.

For additional information, please contact *Nemal Electronics International, Inc., 12240 NE, 14th Avenue North, Miami FL 33161; (305)-893-3924.* Reader Service number 484.



The TCS-2 tunable CTCSS board by Midian.

MFJ-204 ANTENNA BRIDGE

The new MFJ-204 antenna bridge gives an accurate reading of your antenna's resistance (up to 500 Ohms) and covers all of the ham bands up to 30 MHz. When used to measure the resonant frequency of your antenna, you can check to see if the resonant frequency is higher or lower than desired. Then you can lengthen or shorten your antenna based on the information gathered with the MFJ-204 antenna bridge. It's easy to use: Just connect the antenna coax lead to the antenna bridge, set the frequency that you desire, and adjust the bridge for a null meter reading. Then read the antenna resistance from the dial.

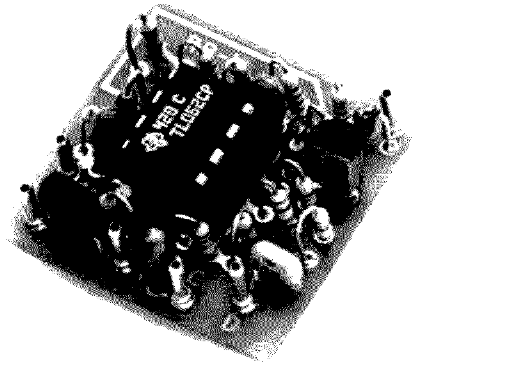
The MFJ-204 antenna bridge also has a frequency-counter jack for precise frequency measurement, and can be used as a signal generator.

The antenna bridge is enclosed in a 4" × 2" × 2" black aluminum cabinet. The MFJ-204 operates on a single 9-volt battery or 110 V ac with an MFJ-1312 adapter.

For more details, contact *MFJ Enterprises, Inc., PO Box 494, Mississippi State MS 39762.* Reader Service number 485.

REVERSE-BURST ACCESSORY

Communications Specialists has introduced the RB-1 reverse-burst accessory. The RB-1 eliminates the long squelch tail heard with some reed-type and other subtone decoders. When used in conjunction with decoders that offer squelch-tail elimination, the RB-1 will delay the transmitter turn-off time and reverse the phase of the encoded tone. This immediately stops the decoder and eliminates the squelch tail.



Model RB-1 reverse-burst accessory from Communications Specialists.

For more information about the RB-1 and other tone products, contact *Communications Specialists, Inc., 426 West Taft Avenue, Orange CA 92665-4296; (800)-854-0547.* Reader Service number 487.

INTERNATIONAL RADIO CRYSTAL FILTERS

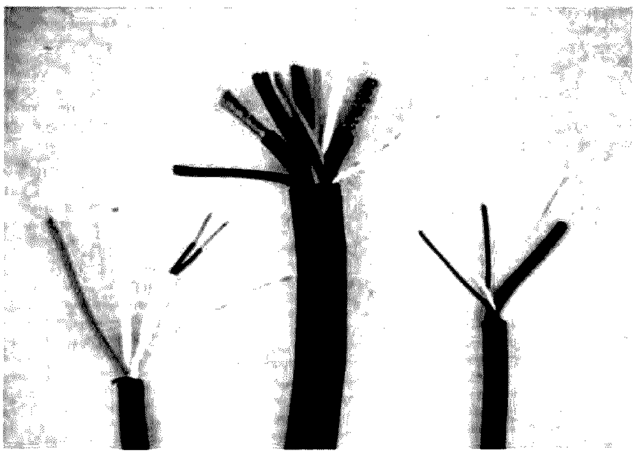
International Radio, Inc., has announced a line of eight-pole narrow filters designed to improve the selectivity of Kenwood and ICOM products.

Several kits are available, covering a wide variety of equipment and applications. Additionally, switch kits are available which allow users to switch back and forth between the rig's original filters and the new narrow filters.

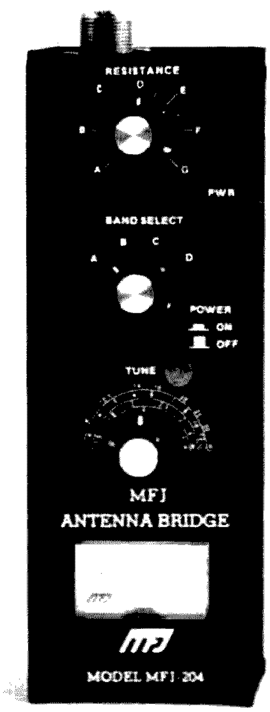
For further information, contact *International Radio, Inc., 1532 SE Village Green Drive, Port St. Lucie FL 33452; (305)-335-5545.* Reader Service number 480.

COMMODORE/VIC RTTY/CW INTERFACE

This new radiocommunication package from Newsome Electronics offers Commodore/VIC owners a complete RTTY/CW



New control cables from Nemal.



The MFJ-204 antenna bridge.

system. Features include automatic speed scanning, 60-, 66-, 75-, 100-, and 132-wpm Murray, 110- and 300-baud ASCII, on-screen tuning indicators, an MSO program, 5-127-wpm CW, and crystal-controlled transmit tones.

The TU plugs into the computer's user port, and is fabricated using a solder-masked glass epoxy circuit board with plated-through holes. The only items needed for operation are two cables: audio in and audio out.

For further information, please contact *Newsome Electronics, 19675 Allen Road, Trenton MI 48183*. Reader Service number 488.

REVIEW

STOP-SCAN FOR THE KENWOOD TS-430S

I purchased a Kenwood TS-430S recently and have been extremely pleased with the operation of the rig with the exception of the scanning feature. Whether you're in program or memory scan modes, the scanner does not stop on an active frequency. In the memory scan mode, it pauses for about one second on each channel and then continues on to the next one, whether the frequency is busy or not. In the program scan mode, it scans a band of frequencies between an upper and lower limit set by the operator. In this mode, it just sweeps right past a busy frequency without any delay. Needless to say, this makes listening to a QSO in either mode very difficult because you only hear a maximum of one second or so of the transmission before it jumps on to the next channel, unless you're fast enough to hit the manual hold button.

At a local ham-swap, I saw the answer to my scanning problems. The JABCO company had a booth selling a PC board that stopped the scan whenever a signal broke the squelch, whether in program or memory scan mode, and it worked on AM, FM, CW, and SSB too!

I bought the kit version and after about 40 minutes of assembling and installing the kit, my Kenwood was scanning just like a police scanner. The kit came complete with illustrated instructions and assembly was pretty simple. There are only two ICs and a small handful of other parts that fit neatly on a 2" × 2" PC board. Adding a couple of IC sockets for the two ICs might not be a bad idea. Six wires connect the Stop-Scan to the 430S. Four of the wires plug down into the small PC sockets located on the top PC board in the Kenwood (everything is located under the top cover of the 430S). Two of the wires are soldered to the trace side of the same PC board.

This doesn't involve any more effort than it takes to add an accessory filter; the Stop-Scan instructions are quite clear on where all the interconnecting wires go and the Kenwood manual also has very clear instructions on opening the top cover and gaining access to the trace side of the PC board. On page 21 of the manual, Fig. 6-4 shows the filter disassembly detail. Once the top PC board is flipped, the Stop-Scan instructions show where to solder the two wires using a drawing of the traces showing them soldered in place.

After about 40 minutes and a cup of coffee or two, I was installing the cover back on the 430S. JABCO makes no recommendations as to mounting the Stop-Scan PC board, but since it's so small, I simply taped it up and found one of several spaces to place it. It's pretty snug inside there, but there was ample room for the Stop-Scan. Once the cover is on, the board stays right in place.

The Stop-Scan works exactly as advertised and has performed flawlessly. It is completely automatic in operation (no on/off buttons to mess with) and requires absolutely no modifications to the Kenwood. Nice for the warranty! It also is well isolated from the 430S by using rather high value resistors in series with the line coming from the Kenwood. The resume scan delay time is adjustable from about one second to about ten seconds by a small PC-mounted pot. I usually have it set at about two or three seconds. The stop action is controlled by the squelch circuit so that whenever the squelch breaks, the scan will stop. It doesn't use anything from the audio circuit so that the af gain (volume controlled) can be set anywhere with no effect on the Stop-Scan. The PC board is well made, the instructions are clear, the Stop-Scan works, and now I have a complete dream rig!

The kit sells for $18.95 but we Indiana residents have to add 5% sales tax. The kit is available through *JABCO, R1, Box 386, Alexandria, Indiana 46001*. Reader Service number 477.

Craig Graham KC9IY
Muncie IN

WELZ SP-45M SWR/POWER METER

Recently, I decided to purchase a dedicated VHF swr meter to complement my two-meter base station. I wanted to be able to accurately adjust the many commercial and home-brew antennas that I have accumulated. I headed to the local amateur-radio store and took a look at the various models available. Of primary importance were price and design. I wanted the meter to be easy to use, well designed, and portable, yet suitable for extended use in the shack. The Welz SP-45M swr and power meter, which I chose, meets these specifications and many more.

Specifications

The Welz SP-45M is designed for operation between 140 and 470 MHz at up to 100 Watts (CW). The meter has three selectable power ranges: 3, 20, and 100 Watts. It will measure forward power, reflected power, and swr between 1 and 10. The minimum power it will accept for an swr measurement is 3 Watts.

The antenna connectors are standard UHF type (SO-259). The unit weighs 0.59 kg and measures 16 cm wide by 6.5 cm high by 14.5 cm deep. The front panel is silver and the top and sides are black. Its case is metal and should stand up to even the worst treatment.

All of the controls are located on the front panel, the most prominent being the meter which is located on the left side. It has four scales: swr (1-10), power (0-100 Watts), power (0-20 Watts), and power (0-3 Watts) and is easy to read with white and red markings on a black background. All of the controls are arranged nicely and are very easy to use.

Operation

I first connected the meter between an IC-271A and a yagi. The meter fits in very nicely with the rest of the station and is heavy enough that it is not pulled around by the coax. I proceeded to measure the swr at various frequencies and was pleased with both the performance of the antenna and the meter.

The calibration knob is sensitive enough that positioning the needle accurately is quite easy. The power measurements were accurate and the progressive scales on the meter are designed to facilitate the task of taking readings. Overall, the design and function of the meter are both excellent.

While I plan to use the meter primarily at the fixed station only, there is no reason that it could not be used while mobile or portable. After all, every last dB helps! Using the SP-45M, I adjusted the mobile whip for peak performance and am confident that the mobile station now is in top condition. The case has four pre-drilled holes on each side which could be used for mounting the unit in a car.

The wide range of VHF and UHF frequencies that the meter covers allows it to be used on the 440-MHz and 220-MHz bands in addition to 144 MHz. OSCAR operation immediately comes to mind as one of the many VHF/UHF communication methods that could be improved by properly tuned antennas. Of course, EME and DX work also apply, but care must be taken not to exceed the power ratings of the meter.

The Welz SP-45M VHF/UHF swr/power meter.

Conclusion

No matter what activities you engage in on the VHF/UHF bands, properly tuned antennas are a must, and the SP-45M swr/power meter is the right tool for the job. At the store, it stood out conspicuously among the many meters available because of its capabilities and aesthetic design. I really enjoy having a dedicated VHF/UHF swr meter and don't see how I was able to operate without one! With a price tag in the 90-dollar range, it is not exactly a minor purchase; however, I feel it was worth every cent. And that is about the best praise that anyone can give a product!

For further information, contact *Encomm, 2000 Avenue G, Suite 800, Plano TX 75074; (214)-423-0024*. Reader Service number 476.

Jonathan Mayo KR3T
Media PA

vicCOMM WIZARDRY

A wizard lives in North Carolina. Oh, he is cleverly disguised. The community thinks of him as a medical doctor, his ham friends call him AA4BB, but I know that Ed Cox is a wizard. He is ably assisted by his wife, Marty, who conjures up some pretty amazing magic of her own.

The Coxes publish *vicCOMM, The Microcomputer Journal for Commodore Computer Enthusiasts*. The first issue of *vicCOMM* appeared in January, 1983. To date, five issues have been printed. For amateurs serious about using Commodore computers, those five issues are an absolute gold mine.

Other than the "Command Post" series of articles that died with the sale of *Commander Magazine*, Ed's articles in *vicCOMM* are one of the few consistent sources for advanced applications of computers in the ham shack.

Perhaps one of his most interesting triumphs has been the creation of a slow-scan television send-and-receive program for both the VIC-20 and the C-64. A simple interface puts you on the air with SSTV.

The original version of the SSTV receive program can be loaded and operated on an unexpanded VIC! It was necessary to "compress" the picture somewhat, but the fact that it could be done at all is amazing. An expanded version of the program, requiring memory expansion, allows full-screen display of black-and-white SSTV images.

The hardware included in the Commodore computers lends itself well to slow-scan television reception. With the addition of a simple demodulator, you are in business.

Ed offers the H-31 interface. It is currently available as a wired and tested unit for $40, as a kit for $30, or as a bare board for a mere $8.00. Postage and handling runs $2.00.

I have built several of these units using the bare board and also recently got to try an assembled unit. Ed's craftsmanship is second to none.

Operation couldn't be simpler. The wired unit connects to the user port. Two RCA-type connectors stick out of the back of the board. Received audio is fed to one. Generated SSTV audio is available on the other for transmit.

The necessary software can either be typed from the listing printed in *vicCOMM* or it can be ordered on cassette tape for $5.00 or disk for $7.00. I typed the program in myself, but in retrospect, it would have been well worth the cost to get it ready to run on disk!

How well can a $50 SSTV program and interface work? If you've never seen slow scan, you are sure to be impressed almost immediately.

The only problem I found while monitoring 14.230 MHz, the SSTV calling frequency, was that there are many amateurs with newer color SSTV gear. Obviously, this program won't handle that, but believe it or not, Ed is working on that too!

With a normal SSTV signal, the picture quality using the *vicCOMM* program and H-31 interface is quite good. I've copied beautiful pictures of dogs, cats, owls, scenic views, and even a Dennis the Menace cartoon.

Certainly, the quality of the picture cannot compare with commercial units costing much more, but it is a great way to be introduced to SSTV.

The *vicCOMM* SSTV transmit program allows four messages to be stored in a VIC, or eight messages in a C-64, for transmission. The program is a little disappointing in that only small messages can be saved. Each letter is expanded to many times normal size for clarity. The full Commodore character set can be used, though, allowing for some low-resolution graphics if you are creative.

I found the transmit program adequate for simple CQ slides and such. It at least offers a way for you to participate in SSTV round tables, though you won't win any prizes for the best picture.

Over the last two years, *vicCOMM* has included a Morse send-and-receive program, a RTTY program, and numerous non-amateur programs that could have amateur-radio applications.

The next issue of *vicCOMM* promises programs for sampling, storing, and playing back voice or music. Ah yes, digital audio with a VIC-20! See what I mean? The man *is* a wizard!

A subscription to *vicCOMM* is $9.00 for six issues. Be forewarned that it is published on a somewhat erratic schedule. Even wizards have to work for a living. The wait is worth it, with each issue guaranteed to entertain and amaze you.

Both *vicCOMM* and the H-31 SSTV interface are highly recommended. Write to: *vicCOMM, Box 5491 Duke Station, Durham, North Carolina 27706.* Reader Service number 478.

Jim Grubbs K9EI
Springfield IL

SCIENCE FACT—OR FICTION?

After you have read *Solution's to Tesla's Secrets and the Soviet Tesla Weapons*, you may have the same feelings I did: amazement, awe, admiration, and great interest—mixed with a leavening amount of skepticism.

Certainly, there is no question that Nikola Tesla was one of the great geniuses of the twentieth century; some say of *any* century since the Renaissance. He was the "father" of alternating current who invented the ac generator, and with financial backing from George Westinghouse, succeeded in harnessing Niagara Falls for the production of electricity.

He succeeded in producing electrical and sound oscillations having frequencies beyond anything imagined at the time—prior to 1900! He actually produced millimeter waves and envisioned radar, sonar, remote control, missile guidance systems, and dozens of other "modern" inventions. He produced X rays by a new technique, and "cold light" whereby gas-filled tubes were lit in his laboratory without visible connection to a power source. Beyond that, he had ideas (demonstrated in small scale before dozens of witnesses) for transmitting power through the earth —wirelessly—to any point on Earth. His achievements won him the 1915 Nobel Prize.

Tesla began his life in a small town in what is now Yugoslavia. He came to the United States in his early 20s with just a few cents in his pocket. Although he spoke no English, he found apprenticeship at a small electric motor repair shop in New York City.

From there he began his lifetime of experimenting and studying which led him to the virtual control of nature... and to a sad, bitter, and lonely end in 1943. Tesla was, indeed, a *Prodigal Genius* as he was called by John J. O'Neill, one of his biographers, in the book of the same name.

The book reviewed here is in two parts: *Solutions to Tesla's Secrets and the Soviet Tesla Weapons*, by Bearden, and *Reference Articles for Solutions to Tesla's Secrets*, compiled by John T. Ratzlaff.

Author Bearden's credentials are impressive: he is a nuclear engineer, a war games analyst and military tactician, a retired officer with over 26 years experience in air defense systems, tactics and operations, technical intelligence, anti-radiation missile countermeasures, nuclear weapons deployment, computerized war games, and military systems requirements.

He is currently (1981) with the Alabama division of a large aerospace company where he is involved in determining the future requirements for laser weapons.

All of these lend credibility to the things that he writes about which seem so incredible on the surface... things that he tells us about Tesla and—perhaps more importantly—the recent work done by the Soviets. Let's begin.

Before 1900, Tesla had succeeded in producing and demonstrating the effects of what have since become known as Tesla waves. He repeatedly stated that they were non-Hertzian in nature—being scalar longitudinal waves rather than transverse vector waves.

Among uses for his waves planned by Tesla was the production of "free" energy for the use of anyone, anywhere on earth. All that would have been needed was a Tesla generator to transmit the energy and a suitable "antenna" at each receiving site. Bearden says that this knowledge was suppressed and Tesla was deliberately isolated because of the economic implications of such a device and the threat that it would pose to the established power structure.

According to Bearden, orthodox electromagnetic theory has a basic flaw involving definition of electrostatic potential, and it is this flaw which has prevented scientists and technicians from recognizing and utilizing the Tesla discoveries. The author states that our ordinary three-dimensional electromagnetic theory is merely a special and limited case of four-dimensional scalar electrostatic potential theory, which involves time as the extra dimension. The explanation, with examples, is given in great detail by Bearden, although I had trouble trying to understand exactly what was being said.

The essence is that a Tesla wave is a massless wave which does not obey the laws of physics as known today, and that electromagnetic effects such as radio waves, light waves, and the like are pair-coupled Tesla waves—all of which leads to a new concept of super-relativity which goes beyond the Einsteinian concept.

Naturally, this is all pretty hard to swallow, and the implications may be even more difficult to get down without considerable chewing.

Examples of Tesla waves in action can be seen in the so-called "spooklights" which appear over the mountains at night, especially in areas of tectonic fault zones where highly-stressed quartz-bearing rocks produce piezo electricity and, as a side effect, Tesla waves. Tesla waves can combine with each other to produce what Bearden calls a scalar interferometer, augmenting and diminishing in patterns that follow a Fourier series expansion.

It is also suggested that thunderclouds and severe electrical discharges from cloud to cloud or cloud to ground can produce SEP (scalar electrostatic potential) effects such as ball lightning, plasma, and the like.

Impossible as it may seem, Tesla waves could possibly affect both space and time (individually and separately, or together in various combinations) and therefore affect such "constants" as gravity, mass, inertia, and even human thought!

Other workers in this esoteric field in the early 1900s included James Harris Rogers, who patented an underground and undersea antenna sytem that was used during World War I to communicate with submerged submarines and to communicate with American Expeditionary Forces in Europe *through the earth!*

T. Henry Morey of Salt Lake City succeeded in tapping the limitless "zero-point energy" of space-time itself through his invention and development of special amplifiers. By 1939 he had produced a 29-stage amplifier that produced 50 kilowatts of electricity from a vacuum! The tubes (which had taken Morey years to perfect) were destroyed by a Russian agent after the Russians had obtained the drawings for themselves, and the device! Today, the Morey amplifier is a standard component of many of the Soviet secret weapons and Tesla superweapons, according to Mr. Bearden.

Examples of other available Tesla literature are: *Bedini's Free Energy Generator, Star Wars Now* (including a description of the basic mechanism by which Soviet control of North American weather is possible—and evidence of its extensive testing), *The Bridge to Infinity* (a book about the secrets of gravitation, space-time travel, the world's electromagnetic grid system, and much more), and a 600-copy limited edition of the *Tesla Patent Wrappers*.

This material is described in a publications list available from the Tesla Book Company. The titles are reasonable in price—some are surprisingly low, in fact. The book reviewed here, an 8½" × 11" spiral-bound softcover, retails for $14.00. Please add $1.50 for shipping and handling.

For those of you who may be interested in reading all of the available Tesla literature, plus much more by various authors about similar subject material, write to the *Tesla Book Company, 1580 Magnolia Avenue, Millbrae, California 94030, or call (415)-697-4903.* Reader Service number 479.

Jim Gray W1XU
***73* Staff**

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

My neighbor just stopped over after spending some time up in Punxsutawney. For those of you who remain uninformed, that Pennsylvania town is the home of Punxsutawney Phil, the official Groundhog Day mascot, by whose vision the severity of the remainder of winter is determined each February 2nd. I even used to get a brochure every few years from the amateur-radio group up there which watched out for Phil. Good luck this year!

Well, somehow I guess I should get from that topic to the lead item in this month's column. Unfortunately, I can't think of a smooth way, so let's just plunge in. I have received in the mail the two newest publications from Joerg Klingenfuss Publications, the third edition of his *Guide To Utility Stations* and the seventh edition of the *Radioteletype Code Manual*. These are monumental works, at least one of which should be a part of any RTTYer's library.

The smaller of the two works, the *Radioteletype Code Manual,* is a seventy-one-page booklet that covers the non-ASCII radioteletype codes along with several variations on the Morse code. For those of you who have been looking for the information, here is a detailed description of the CCIR-467-3 specifications that define amateur-service AMTOR along with other ARQ and SITOR standards. Some of the nonstandard RTTY codes covered include those used to send Arabic, Cyrillic, and Hebrew. Of the three, Hebrew is only briefly explained with a code chart, an omission I hope will be corrected in future editions. Somewhat more information is given about Cyrillic, and extensive coverage is given to Arabic, with a long list of words printed on a conventional teleprinter with their Arabic translation. For example, BMYCUB = America and YBRCT = radio. Beyond the conventional five-level code, the book also deals with the third-shift codes, so called because they represent a third character set (other than letters or figures) which is used in the Amharic, Cyrillic, Greek, Korean, Thai, and Japanese radioteleprinter systems.

If that is not enough, some of the more exotic versions of Morse code are covered as well. Alphabets are shown for sending Arabic, Cyrillic, Greek, Hebrew, and Japanese with a code key. There are also entire sections on terminology, how ARQ systems work, and an introduction to simple cryptology. Let me tell you, these are some meaty seventy-one pages!

If these are meaty, try amd imagine the 427-page *Guide To Utility Stations.* Almost an inch thick, this tome of a work covers over 14,000 individual frequencies between 1.6 MHz and 30 MHz, using modes of transmission including CW, fax, SSB, and RTTY in its various permutations. Seventy-eight RTTY press services are listed on almost five hundred frequencies in the master list, as well as in a chronological list by time of day of transmission and alphabetically in country order. Alphabetical indices are also provided for a slew of meteorological RTTY stations,

mnemonic abbreviations, service codes, Q signals, Z codes, utility stations, signal reporting codes . . . well, you get the idea.

As an extra added attraction, three maps are provided, each one 8.85 by 18 inches in size, which show air routes and VOLMET Allotment and Reception areas. Quite a package in one handy book!

These publications, along with several others, are available from Joerg Klingenfuss Publications, Panoramastrasse 81, DF-7400 Tuebingen, Federal Republic of Germany. The prices for the *Radioteletype Code Manual* and *Guide To Utility Stations* are DM25 and DM60, respectively. I presume that the dollar amounts would vary with the current exchange rate. Be sure to let Joerg know you read about it here, OK?

Is anybody out there interested in packet radio? I have received a few inquiries on the subject; one is sitting here from Gail F. Moulton, Jr. WA6KJD of Trona CA. I have asked around to some of the mavens in this area, but it looks like whatever interest existed a few years back has dried up. Drop me a line with whatever you think on the subject.

Another problem area is parts for older RTTY machines. Again, years ago there were many parts houses which stocked platens, print boxes, and gears for various Teletype Corporation machines. Now, with the electronic clean sweep, these sources are few and far between. Specifically, I have a note from Bob Klein K9RTB of Beaver Dam, Wisconsin, who has been looking in vain for a model 28 print box. Can anyone help him out? Send me your name and I will forward it to him. We'll see what we come up with, Bob.

I have been toying with various schemes to put the computer back on the air. One of the things we need to do is look at what each of you who are using a computer on RTTY is using for hardware and software. So, this month, I would ask each and every Apple (I, II, II+, IIe, IIc) or Apple-clone user to drop me a note and tell me what kind of software you are using on RTTY. Now, before I get flogged, *not* McIntosh, Lisa, or the like, *please*. I am trying to compile some sort of order out of all this and hope to do this over the next few months, with the results to follow when all is in.

Meanwhile, the TRS-80C Color Computer* continues to rack up the brownie points here. After examining a versatile expansion bus and 80-column terminal card for the CoCo—more on those later—I am convinced that this is the way to go for the serious user. Total cost of a full RTTY system should be nominal, and it is buildable in stages ranging from a tape-based TV display to a full-disk-access, multi-user, 80 × 24 terminal—and all based on the same computer. There *will* be more on this one later!

I appreciated a comment received from Fred F. Kloman of Laguna Niguel CA. Fred notes the explanations of the various "bit formats" in the September column and indicates the need for a standard. Only one item of confusion in the letter, Fred. You write about the "RS-232 bit format" in terms that suggest you are confusing RS-232, which is the medium, with ASCII, which is the message. One of the points I tried to make in September—I hope I said it clearly enough—is that the American Standard Code for Information Interchange, ASCII, determines the bit format for transmission. Seven bits, eight bits, even six bits for uppercase only have been used, with one, two, or some fraction in between as a stop bit. The point is that all this defines is the format of bits, not the voltage levels on the line. After all, ASCII being transmitted over a radio signal is still ASCII, but it is hardly RS-232. The RS-232 (-C or whatever) standard addresses the voltage levels needed to signal the desired bits over the circuit, without regard for what the particular format in use is—ASCII, Murray, or even Morse! Yes, the two can be related, but no, they are not the same any more than voltage and current are. And that's the message I was trying to get across. Thanks, Fred, for the excellent question.

Fred also asked for, and received, the latest list of reprints of old "RTTY Loop" columns. This column is written too far ahead of reality for me to tell you how many or on what subjects reprints are available, but I have been trying to put together some of the more popular subjects into readable form. An up-to-date list is available by sending a self-addressed, stamped enveloped to me at the above address (request the reprint list). If you want to, add a question, point, or some information for the rest of the readership along with the request—wonderful! Who knows, you may end up like Fred, reading your name in "RTTY Loop."

DX

Chod Harris VP2ML
Box 4881
Santa Rosa CA 95402

DXING IN CONTESTS

Radio propagation has not been kind to DXers in the last year. And there seems to be little reason for hope that the situation will improve. Ten meters provides only occasional flashes of activity, and even 15 meters supports good DXing only during daylight hours. As 20 meters washes out late at night, more DXers are crowding into the lower bands, or (God forbid!) giving up the frustrating practice of DXing at the sunspot minimum.

What can the die-hard DXer do to maintain interest and enthusiasm for the sport? We'll look at a variety of ways in coming months, starting with DXing during contests.

Many DXers hate contesters and contesting, claiming that these weekend fanatics overcrowd the bands and destroy any chance for serious DXing. However, in all but a couple of contests, the other mode is seldom affected by the contest. For example, even if the *CQ* Worldwide DX Contest fills the phone bands, there is always CW. And seldom do contesters completely fill a band; the upper end is usually free of the contest frenzy.

DX contests offer the DXer some unique opportunities to expand his DX horizons, and also to add a few more new ones to that DXCC total. Since the spring contest season is about to begin, let's see how you can work several new countries, practically painlessly, during a DX contest.

What advantages do contests offer the DXer? First, contests create a lot of activity on the bands. Stations which seldom operate often gear up specifically for a major contest, providing more DX opportunities. Also, these stations are trying to make as many contacts as they can, since that is, after all, the point of the contest. These DX stations are actually eager to work you.

So you have a lot more stations on the air, all more than willing to listen for your call. DX contests also bring out many DXpeditions to rare and not-so-rare places. While no major DXpedition to a "most wanted" spot will pick a contest weekend to operate, many "suitcase DXpeditioners" head to the Caribbean, the Pacific, Africa, and South America to operate during the contest.

Unlike resident DX hams, these contest DXpeditioners have not yet tired of working hundreds of stateside hams, so your chances of a successful contact improve. Typically, these contest trips feature a stateside QSL manager, which simplifies the confirmation process (more on this below).

Finally, contests provide many DX opportunities on the marginal bands. Even if 10 meters is closed there will be a few hard-core contesters on the band keeping it warm. Under identical conditions without the contest, the band would be completely dead, but during the contest, there will always be a few stations on the air. Since these stations are calling CQ into a dead band, if you can hear them, you can probably work them with little competition.

You don't have to enter the contest to participate. In fact, only a small fraction of the hams who make contacts during the contest ever submit logs to the contest organizer, which is the usual means of entering the contest. Most hams simply include their contest contacts in with their other QSOs in their logs. No need for any special forms, log sheets, or other paperwork.

However, you *should* have a copy of the rules of the contest at hand. Before the contest, read through the rules until you are thoroughly familiar with the descriptions of permissible contacts and the complete contest exchange. You can find the rules in an issue of the magazine of the sponsoring organization, or by writing to the sponsor and asking for a copy of the rules. Always include a large self-addressed, stamped envelope with your request.

You must be familiar with the rules so that you can make contacts in the contest as rapidly as the more active participants, to keep the DX station happy. Also, you want to ensure that your contact with the DX station complies with the rules of the contest, so that your log entry isn't deleted after the contest is over.

Fortunately, the rules for most major DX contests are very similar. You may work stations outside your own country (and some within your country) once on each band. DX contesters take a very dim view of duplicate contacts on the same band ("dupes" in contesting lingo), so try to make your contact count the first time. If you cannot sleep without an "insurance" contact, make it on another band.

I've had stations work me a half dozen times on each band, and QSL every contact. This means I have to carefully remove each duplicate contact from my contest log before I send it in, because there are severe penalties for failing to remove the dupes. Obviously, I am not going to look with favor upon the DXer who works me several times on each band.

The other reason to check the rules is to learn the proper exchange for the contest. By reading the rules about the contest exchange, the DXer can call the DX station, provide exactly the right information for a complete contest contact, and leave the DX station to his point-gathering. If the DX station has to ask a series of questions to get the information he needs, he might simply forget about your contact, and work someone else.

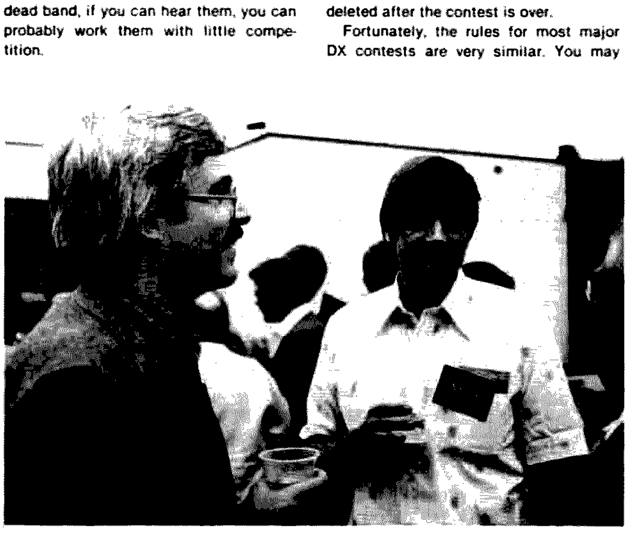
For most DX contests, the exchange is very simple: the DX station's callsign, signal report, and one additional piece of information. The latter might be a geographic designator, such as *CQ* or IARU zones or the states. In some cases the additional piece of information exchanged is a consecutive serial number. Before the contest begins, prepare the information you should send to the DX station.

About signal reports: Contesting signal reports are *always* 59 or 5NN. Nobody pays any attention to these figures, and sending other than a 59 or 5NN simply confuses the DX station. In fact, many contesters duplicate their logs with the "59" already in place.

Yes, it certainly seems silly to slave to pull some contact out of the mud, and then turn around and give a 59 report to a station whose callsign you could barely copy, but giving accurate signal reports in a contest wins no friends!

Making the Contest QSO

Okay, now you're all set for the start of the contest. Your log is ready, you know the rules, and you have the contest exchange you will send all prepared. So how do you work new DX countries in the me-



Dick Norton N6AA (right) discusses contest strategy with Rick Niswander K7GM. Dick has made many thousands of contest QSOs from 9Y4VT in the CQ WW Contests.

lee? Since you are not seriously entering the contest, your strategy will be different from that of the regular contest entrant. Presumably you have little interest in working strings of Japanese or German stations (if you do, why not enter the contest more seriously?), so you can ignore most of what you hear.

A good way to separate the DX you want from the rest of the contesters is to keep a "band plan." As you tune across the band listening to the pileups, you can identify the calls of the DX stations (or stateside stations calling "CQ TEST"). One or more of the pileups might contain a station you need, but the rest you can quickly tune by. By logging the frequencies of the stations you need, you can quickly tune back and forth, while skipping all the other contesters.

Pileup busting works the same way in contests as in DX, and many of the same techniques work. Avoid giving only part of your callsign, however, and never repeat your call in a contest pileup. The DX station might well get your entire call on the first try. Also, if one call didn't work, wait until the next QSO and try again.

If you find your peanut whistle isn't cracking the big pileups, don't despair. Try a different band, where the competition isn't as fierce. Or try at a different time of day, or later in the weekend. By Sunday afternoon, many of the major DX contesters have worked all the Big Guns in the contest and are now copying much weaker signals. Give it another try!

A good sign that you're *not* getting through is when the DX station continues to call CQ after your call. If he can hear anything at all, he'll probably try to make the contact rather than continue to call CQ.

Unfortunately, not all the good DX on the air during the contest consists of large, well-equipped stations on every band calling CQ. Some will be distinctly weaker, on for a shorter period of time, and generally more difficult to work. While not "sure things" like the big contest DXpeditions, these DX stations are usually workable by average stations. The trick is to keep tuning around the bands which are open, listening for these signals. Your band plan can help you skip over many of the pileups, so you can scan several bands in a short period of time.

Look for the DX stations near the fringes of the contest QRM. The really Big Guns slug it out down in the lower reaches of the band; higher up the weaker stations gather. So tune up to where the contesters begin to thin out. You'll often find some good DX up there, hiding from the hordes.

Working the "Hunt and Peck" Station

Perhaps the most frustrating aspect of contesting with other than a winning station is to listen to the great DX which is calling one of these superstations. The Big Guns call CQ continuously, and their strong signals attract a lot of choice DX.

Obviously, you can't hope to compete with some of these guys. The DX is not going to flock to your door in the same manner. But just because you don't own a Big Gun station doesn't mean you can't work much of this choice DX.

These "hunt and peck" stations tune across the band, answering CQs. They usually move in one direction along the band, jumping into every pileup. If you can tell which direction this DX station is tuning, you have good chance of working him, even with a peanut whistle.

After you have worked the few DX stations which are calling CQ themselves, you might start listening to a strong stateside station near the bottom edge of the band. When you hear one of the rarer DX stations calling the stateside contest CQer, tune up the band and see if you can follow that rare station. Perhaps you will hear it again a few kilohertz higher in the band, calling another CQer.

Once you have established a pattern for the DX station, try to get a few kilohertz ahead of him. Tune up a little higher in the band than his last contact, and, wedging between the other stations, call a CQ, a directional CQ, or even call the station directly.

Since the DX station is tuning for CQs, and your CQ is just higher in frequency than his last contact, the odds are that he might just hear your CQ and call you. Even if the frequency you choose is very crowded, you might be able to make that single contact.

A directional CQ might improve your chances. If the station you want is from Africa, try calling "CQ Africa" when you get a few kilohertz ahead of him.

If the station you want doesn't answer your CQ, check the next higher pileup to see if he skipped over your weaker signal. If so, get ahead and try it again. If there is as much as a moment's pause between the Big Gun contesters, you have good chance of making the contact.

Another way of snagging those rarer stations working the Big Gun DXers is to try to call the DX station on the Big Gun's frequency. This technique takes very careful timing and a reasonably understanding Big Gun. Typically, you call, "T32AW, up five!" when the Big Gun is not transmitting. Of course, the DX station cannot be transmitting, either, which makes the timing so important. In a hectic contest, there aren't many gaps between transmissions.

If your timing was good and the Big Gun didn't jump all over your signal as soon as you started to transmit, the rare DX station might well listen for your call for a few seconds five kilohertz higher. That frequency doesn't have to be clear, as you will only need it for a moment.

By the way, unless you have a very good signal, don't try to work the DX station on the same frequency as the Big Gun. Said Big Gun will most likely start calling CQ right over your peanut whistle.

Confirming the Contest QSO

The contest is over, the bands have returned to normal, and your log contains a half dozen new countries. Now we come to the tough part: getting the QSL.

If you look for differences between a DXer and a contester, about the most glaring is QSLing. To the DXer, those QSL cards are the reason for the entire exercise. On the other hand, QSLs are just a pain to the contester. After every major contest, the active contester is swamped by QSL requests.

To some contesters, QSLs simply aren't worth the trouble and expense. QSL requests are simply filed in the Circular File. I know one contester who even throws away SASEs. The only thing in which he is interested is the occasional dollar bill. So your QSL return rate for contest contacts will be even lower than normal.

There are a few things you can do to improve your contest QSL return rate, however. First, get the proper QSL address for the contact. Don't ask the poor DX station in the middle of a contest for his QSL information. Either he will give that information on a regular basis, on the hour, for example, or you can find the QSL route via your club newsletter, DX bulletin, or other source.

Note that many club stations have special QSL routes for contests. 4U1ITU in Geneva might have different QSL managers for each contest, depending on the guest operator for the contest.

Pay particular attention to the contest DXpeditions. It is seldom useful to send a contest DXpedition QSL card via the bureau. The card will never get to the country before the DXpeditioners have departed, and there is often no way to forward these contest cards. There are literally thousands of QSLs gathering mold on Montserrat, all bureau cards for DXpedition contacts, with no forwarding addresses. Or, take my recent trip to T32AW. There is *no* regular mail service to Christmas Island. No ham on Christmas has ever received a QSL card via the bureau. So find out what the correct, stateside QSL route should be and use it. I find the W6GO/K6HHD QSL Manager List (PO Box 700, Rio Linda, CA 95673) quite accurate and useful.

Another trick to improve you chances of confirming a contest QSO is to indicate on your QSL card that this was a contest contact. Many active DX stations keep their contest logs separate from their main log. If you simply indicate the date, without mentioning the contest, the DX station might notice no QSOs in his regular log for that date and fail to answer.

Accurate timekeeping is vital for contest QSLing. A contester might make 6-7 contacts a minute and fill a contest log page in less than 10 minutes. If your clock is off by 5-10 minutes, the DX station might have to search through dozens or hundreds of contacts for your call. Or he might get tired of this and return or discard your card. So check your station clock against WWV before the contest begins.

And be careful about band changes. It is very easy in a contest to change bands and forget to record this information in your log. If you send out the card based on incorrect log data, the DX station might find he wasn't even on the band you claimed. On those rarer contacts, double-check the band right after the contact, or better still, make out the QSL card right on the spot.

One final tip for better contest QSLing: In contests with a consecutive serial number, give the *DX station's* serial number on your card, not your own. In the *CQ* WPX Contest, for example, write "UR # 1056" on the card. Assuming you logged the correct number, your QSO will be very easy to find, even if you got the time and band wrong.

DXing during contests is not easy, but it can be very rewarding. And who knows, you might even discover you *like* the frantic pace and excitement of the radio contest. Even if not, you can catch a few new ones and work on your band country totals over the weekend. See you in the pileups!

SATELLITES

USING THE AO-10 APOGEE PREDICTIONS

Apogee predictions for the month of February are provided for three sections of the United States: Washington DC at 39N 77W, Kansas at 39N 95W, and California at 38N 122W. Times are in UTC and apogee in this case is mean anomaly 128 rounded to the nearest whole hour. Use the chart as a guide in aiming your antenna, then fine-tune the azimuth and elevation values to peak the satellite's beacon signal. If you require more accurate orbital predictions, contact AMSAT at PO Box 27, Washington DC 20044.

			WASH		KANSAS		CALIF	
ORBIT	DAY	TIME	AZ	EL	AZ	EL	AZ	EL
1233	1	1600	138	45	118	33	97	12
1235	2	1500	123	39	107	25	88	4
1237	3	1500	121	33	106	19		
1238	4	0200					274	0
1239	4	1400	110	25	97	11		
1240	5	0200					268	3
1241	5	1300	100	17	89	3		
1242	6	0100					262	13
1243	6	1300	99	11				
1244	7	0000			272	1	255	23
1245	7	1200	91	3				
1248	8	2300	272	0	260	13	240	34
1250	9	2200	266	8	253	23	228	43
1252	10	2200	260	10	247	24	219	44
1254	11	2100	253	20	237	34	203	50
1256	12	2000	245	30	226	43	182	54
1258	13	2000	238	31	217	43	173	50
1260	14	1900	226	40	201	49	153	49
1262	15	1800	212	47	181	52	136	44
1264	16	1800	202	46	172	48	132	38
1266	17	1700	183	50	153	47	120	31
1268	18	1600	163	50	136	42	109	23
1270	19	1600	156	45	133	36	108	17
1272	20	1500	140	41	120	29	99	9
1274	21	1400	125	35	109	22	91	0
1276	22	1300	114	28	100	13		
1277	23	0100					270	0
1278	23	1300	112	22	99	8		
1279	24	0000					264	9
1280	24	1200	103	14	91	0		
1282	25	1100	94	5				
1283	25	2300			269	0	251	21
1284	26	1100	93	0				
1285	26	2200			262	9	243	31
1287	27	2200	268	0	257	11	235	32
1288	28	2100	262	7	249	21	224	41

BE MY GUEST

Guest Editorial by Bill Pasternak WA6ITF

THE DARK SIDE

I hadn't really planned on being in the Big Apple that weekend, not with the Democratic Convention followed by the Summer Olympic Games and then the Republican conclave. As a broadcaster, it was for me a rather busy summer, and if I was going to be anywhere other than Los Angeles that weekend, I expected it might have been Dallas. As the draw of the cards would have it, the TV station that I work for elected not to send a crew to the Republican conclave, so I had no excuse not to attend my brother-in-law's wedding out on Long Island.

Travel arrangements were hastily made. My wife had departed earlier in the week, and as the sun broke over the Verdugo Hills, the American Airlines DC-9 Super 80 Jetliner I was on broke free of the tarmac at Hollywood-Burbank Airport and roared skyward. As we made our climbing turn to the northeast, the sunshine broke through the cabin windows and I beheld the City of Angels far below. Soon we were at 39,000 feet and cruising at better than 600 mph toward Chicago. For the next 3½ hours I slept. In fact, it was the main gear touching down at O'Hare Airport in Chicago that brought me back to my senses. "What a delightful ride," I thought to myself, "the start of a perfect, though hurried, weekend." Ten minutes later I was eating lunch at one of O'Hare's many food stands with my friend Joe Schroeder W9JUV, and a hour later I was airborne again on a Boeing 727 headed toward New York City and La Guardia Airport.

One of the nice things about arriving in New York via La Guardia is that you can play "flying traffic reporter" as the aircraft descends toward the runway. From either side of the aircraft you get a spectacular view of the New York City highway system, and it can help you to plan your driving strategy, especially during rush hour. That is, if you know which highway is which. Having been brought up in the city, and having learned to fly light aircraft there, the landscape was quite familiar. Soon I had picked up the rental car, had the mag-mount on the roof, the IC-2AT plugged into the cigarette lighter, and was headed west on the Grand Central Parkway. A quick interchange to the southbound Brooklyn-Queens Expressway and I was on the last leg of my trip.

A few of my friends knew that I would be arriving, so we had scheduled a repeater to meet on to chat. Alas, that one was down, but New York City is overflowing with machines, and a bit of searching brought me to the Metroplex system. Soon I was in QSO with a number of old acquaintances, and in short order my friends located me on the Metroplex box. That repeater, being the meeting place for just about every ham in the New York/New Jersey area, is always very busy, so my friends and I QSYed to a quieter system that one of them suggested. We talked until I "destinated," after which the HT was put away in deference to family obligations. After almost a week of playing bachelor, it was nice to see Sharon again.

It was the next morning that the unfortunate incident occurred. My wife and her folks had left early to take care of some last-minute preparations, and I was to meet them out on Long Island a few hours later. With nothing much to do, I decided to drive over to my old neighborhood to take a look around. Just for nostalgia's sake. Even though this was my fourth trip to New York this year, in the past all had been for business and had left no time to look and see how time had treated the place where I had grown up.

With the 2-meter radio still set to the repeater used the night before, I began my drive down Avenue K. My first stop would be on East 18 Street to say hello to Max Levy, the father of my longtime friend Larry Levy WA2INM. Larry's mom and dad had always been my second family, and whenever time permitted I would visit them if I was in town. Carol had passed on a few years ago, but Max was still living in that same beautiful house that gave birth to many 6-meter DX records of the late 1950s and early 1960s, when Larry and I would spend hours tinkering, building and improving his station. The Telrex beam was gone, but the memories of those days were still very much alive.

I was near Nostrand Avenue and in QSO with a couple of amiable chaps when an acquaintance of many years broke in to say hello. Since he lived in my old neighborhood, I suggested that we have a late breakfast together. As he attempted to reply, his transmission was jammed. I attributed this to the same type of mentality that appears to abound on 2-meter repeaters in the Los Angeles area, and asked that he repeat his answer. Again he was jammed, but this time with a new twist. Instead of an unmodulated carrier, as had been the case a moment earlier, this time the jamming station announced quite clearly that he was jamming the station I was in QSO with *because my acquaintance was not welcome on the machine!* I was so dumbfounded by this that I instinctively reached for my pack with the tape recorder in it, and almost ran the car onto the sidewalk in the process. "The nerve of this *!!?*! Who in the !@*! does he think he is? A repeater god?" I thought to myself. Another unidentified station who was also being partially jammed by this self-annointed repeater cop helped to clear the air a bit by saying that it was the practice of that particular machine to censor anyone they didn't want on. I'm still not exactly sure as to what he did say, since his partner in grime was busy keying down, thinking he was jamming out the station I was attempting to QSO. Since it soon became obvious that the censorship was selectively aimed at the other station in the QSO, I knew that he could hear me and suggested that we go to simplex, since I was sure that we were in range to make direct contact. Bidding a not-so-fond farewell to the channel cops, we QSYed to .52 where we were not again interrupted.

I made a quick stop to see Max, and then drove over to have breakfast with my ham buddy. I didn't bother to ask him why he had been treated so discourteously on that particular repeater, nor did he bother to offer this information. Frankly, I felt that part of it was between him and the rest of the system, and not my concern. Or was it?

After we bid each other farewell, I drove up and down several blocks of my old neighborhood, passing the houses where I grew up, the public school I attended and the like, but my mind was not on the scenery. Rather, I could not put that incident out of my mind. The disgusting lack of courtesy displayed by that channel cop and his supporters was something I could not stomach. In my mind, what had transpired an hour earlier was the epitome of wanton, vicious, and *intentional* malicious interference. The words of FCC Private Radio Bureau Chief Robert Foosaner kept going through my mind. "...there are always reasons for jamming, but we (the FCC) don't care what your reasons are. If you do it, we will catch you and we will take away your license..." To me, channel cops, especially the self-annointed variety, exist at the same level as those who perpetrate acts of malicious interference so as to gain attention. In this case, the two were one and the same. Had it not been a Saturday, I probably would have found the nearest pay telephone and called Carol Fox Foelak of the FCC's Compliance Division to give her a first-hand "ear-witness" account of this incident. The channel cop should thank the Lord that it was a weekend, and that Washington was locked up tight. I did have Johnny Johnston's home number in my little blue book, but decided that doing the "big number" on the channel cop wasn't worth disrupting Johnny's weekend. Still, i was burning mad, and I guess that I still am, for several reasons.

First, and most importantly, whatever it was that was so disliked by the users of this repeater about the station I was QSOing was no justification for violating the law. Yet this self-styled channel policeman not only had the gall to violate Part 97, but the pride to *announce that he was doing it!* To this writer, that is malicious interference of the worst kind, ranking with the utterance of obscene language for the sake of doing so. Both are wrong. Both are violations of the law. Both deserve punishment.

Just as upsetting was the overall rudeness of the channel cop and his obvious supporters toward a visitor. If this had been a private repeater with a selective usership, then I might have been able to accept the fact that visitors were unwelcome, had that been explained. Being a user on two such systems in Los Angeles, I can understand that type of thinking. But this was an open system, and a fairly popular one at that. The unwritten rule pertaining to open systems is that *all* comers are welcome. At least that's the way it is elsewhere in the United States. Had one of the control stations come onto the channel and asked that we QSY, I would have been happy to oblige. I'm not one to go where I am not welcome. But that didn't happen. Instead, the users took it upon themselves to censor a station I wanted to converse with, and in doing so, took the law into their own hands, vigilante style. This is something I cannot ever accept.

I hasten to add that this problem appears to be isolated to one particular NYC system at the moment, and I have written to the system's licensee, apprising him of the matter. Maybe he can find a way to gain control over his usership and explain that their activities are placing *his* license in jeopardy, as he is held legally responsible for the manner in which the system is operated. Who knows, maybe they will even listen to him. Probably not, if I know New Yorkers. It was that type of attitude that was in part responsible for my moving away.

Either way, I think it is important to point out that hate only breeds more hate, and on a repeater this can only lead to chaos and anarchy. I bear witness to this, and I can only hope that the channel-cop cancer does not spread. It was the channel cops who were responsible for most of the chaos during the STS-9 "Ham In Space" operation last year, and we don't need a nationwide repeater network filled with them.

Bill Pasternak WA6ITF is the Network Director for Westlink. *A broadcast engineer by trade, Bill has been a contributor to* 73 *for many years.*

CORRECTIONS

Two corrections to "Ntty Grtty RTTY" in the September, 1984, issue have come to our attention. First, in Fig. 1 on page 39, the lower-left op-amp section should have a 0.1-uF capacitor connected between the wiper of the 100k pot and the 33k input resistor. Second, in Fig. 2 on the same page, pin 4 of IC4 should be brought to ground.

Peter Putman KT2B advises us that in his January, 1985, article, "That Glorious Gonset," the diodes specified for the new power supply (D1-D4) may not have a sufficient reverse-voltage specification. Peter suggests using instead the circuit shown in Fig. 1.

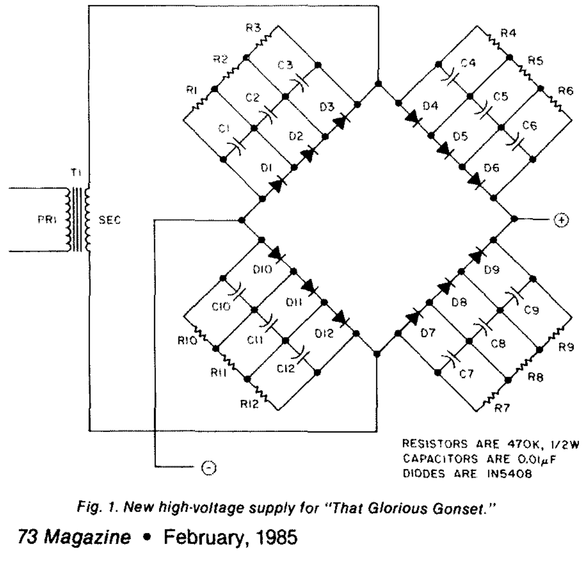


Fig. 1. New high-voltage supply for "That Glorious Gonset."

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

ANNIVERSARY OF THE BATTLES OF KWAJALEIN AND ROI-NAMUR
Starts: 0600 UTC February 1
Ends: 0600 UTC February 9

KX6BU will again be on the air commemorating the 41st anniversary of the battles of Kwajalein and Roi-Namur. Frequencies will be 28.600, 21.350, and 14.250 on SSB, plus 28.050, 21.050, 14.050, and 7.050 on CW. Stations working KX6BU will be issued a QSL certificate for $3, or a 64-page book of the Battles of Kwajalein and Roi-Namur will be included for $6. All requests should be sent to KX6BU, Box 444, APO SF 96555-0008.

WAKI, the Worked all Kwajalein Award, is still available to any station that has confirmed five KX6 stations located on Kwajalein Atoll, including Kwajalein, Ebeye, and Roi-Namur islands. Anyone desiring a WAKI certificate should send a list certified by a club official containing the callsign, band, mode, and date worked. Send the list to KARC secretary, PO Box 444, APO San Francisco 96555-0008, along with $5.

VERMONT QSO PARTY
Starts: 0001 UTC February 2
Ends: 2400 UTC February 3

Sponsored by the Central Vermont Amateur Radio Club (W1BD). Each station may be contacted once on each band and mode (CW, phone, RTTY). CW and RTTY contacts must be in the CW and RTTY subbands. Duplicate and repeater contacts are invalid.

EXCHANGE:

RS(T) and state, province, country, or two-letter designator for VT county (AD, BN, CA, CN, EX, FN, GI, LA, OG, OL, RU, WA, WM, and WR).

FREQUENCIES:

Phone—3.910, 7.230, 14.260, 14.320, 21.360, 28.570, 50.110, 144.200; CW—3.540, 3.720, 7.040, 7.120, 14.040, 21.040, 21.140, 28.040; RTTY—3.620 and 90 kHz from lower edge of other RTTY subbands.

SCORING:

Score one point per phone contact, 5 points per CW or RTTY contact. VT stations multiply QSO points by number of VT counties plus states plus Canadian provinces plus ARRL countries (exclude US/Canada). Others multiply QSO points by the number of VT counties (14 max.). Add 20 bonus points for working W1BD.

AWARDS:

For non-VT stations, certificate to highest scoring station in each state, province, and country. Certificates will be awarded to each VT station submitting a log, and a plaque will be given to the highest scoring VT station. WVT Award will be given to stations working 13 of Vermont's 14 counties.

ENTRIES:

Send an SASE for the official log and score sheets. Send logs/facsimilies, name, class of license, and address—not later than March 1st—to: D. Nevin KK1U, W. Hill, Northfield VT 05663. Include an SASE for a copy of the results.

NEW HAMPSHIRE QSO PARTY
1900 UTC February 2 to 0700 UTC February 3
1400 UTC February 3 to 0200 UTC February 4

Sponsored by the NH Amateur Radio Association. Stations may be worked once per band and mode. NH stations may work each other.

EXCHANGE:

Send RS(T) and country, state, VE province, or NH county.

FREQUENCIES:

Phone—1.875, 3.975, 7.235, 14.280, 21.380, 28.575, 50.115, 145.205; CW—1.810, 3.555, 7.055, 14.055, 21.055, 28.055; Novice—3.730, 7.130, 21.130, 28.130; RTTY—3.625, 7.085, 14.085, 21.085, 28.085.

SCORING:

NH stations score 1 point per QSO, multiplied by the number of states (except NH) plus countries (except US, Canada, Alaska, and Hawaii) plus NH counties. Others score 5 points per NH QSO times the number of NH counties worked (10 maximum). In addition, all stations count 20 bonus points each for working the following NHARA member club stations: WB1CAG, W1OC, WB1FFZ, K1RD, and W1WQM, for a maximum of 100 bonus points.

AWARDS:

Certificates will be awarded to the highest scorer with a minimum of 5 QSOs in each NH county and state, province, and DXCC country. A plaque will be given to the highest scorer in NH courtesy of the Concord Brasspounders. A Worked All NH Award, sponsored by W1JB, will be given to participants who work all 10 NH counties.

ENTRIES:

Send your entry no later than March 15, 1985, to: Great Bay Radio Association, PO Box 911, Dover NH 03280. Include a large SASE for results.

DUTCH PACC CONTEST
Starts: 1200 UTC February 9
Ends: 1200 UTC February 10

Use all bands, 160 through 10 meters, on CW and SSB. No crossmode operation allowed. Each station may be worked only once per band regardless of mode. Operating categories include single operator, multi-operator, and SWL.

EXCHANGE:

RS(T) plus sequential QSO serial number starting with 001. Dutch stations will send their two-letter province abbreviation instead of a QSO number (GR, FR, DR, OV, GO, UT, YP, NH, ZH, ZL, NB, and LB).

	QSOs	Points
K1KI	216	9,288
K2SX	66	1,386
W3ARK	117	2,340
N4MM	78	1,638
KN6O	4	12
K8PYD	42	756

The US call district winners in last year's Dutch PACC Contest.

SCORING:

Each QSO with PA, PB, or PI counts one point. Multiply QSO points by the number of provinces worked on each band (6 × 12 = 72 max.).

SWLs count one point per Dutch station heard and multiply by provinces heard on each band (72 max.).

ENTRIES:

As usual, a score calculation is required. Please use a multiplier column and insert multipliers only if a new one. A log must be signed for observation of the contest rules. SWL logs must contain code groups given by the Dutch station and the foreign station worked. Send logs not later than March 31, 1985 to: PA0INA, F. Th. Oosthoek, PO Box 499, 4600 AL Bergen op Zoom, Netherlands.

A certificate will be awarded to the winner in each country in each category along with the second- and third-place stations, provided that there are sufficient participants in that country. Certificates will also go to winners in each call district of JA, LU, PY, UA9/0, VE/VO, VK, W, ZL, and ZS.

YL-ISSB COMMO SYSTEM QSO PARTY—PHONE
Starts: 0001 UTC February 23
Ends: 2359 UTC February 24

Use the General-class band portion on all HF bands and simplex-only contacts on all VHF bands. Individuals needing applications and instruction forms can send a 4 × 9 SASE to K0RDJ and NA0V, Rick and Minnie Connolly, Star Route 1, Crocker MO 63452. They *do not* furnish log forms.

CALENDAR

Feb 2-3	Vermont QSO Party
Feb 2-4	New Hampshire QSO Party
Feb 9-10	Dutch PACC Contest
Feb 16-17	ARRL DX Contest—CW
Feb 23	RTTY World Championship
Feb 23-24	YL-ISSB Commo System QSO Party—Phone
Mar 2-3	ARRL DX Contest—Phone
Mar 16-17	YL-ISSB Commo System QSO Party—CW
Mar 16-17	Spring QRP CW Activity Weekend
Mar 16-17	Bermuda Amateur Radio Contest
Mar 30-31	Rio CW DX Party
Apr 20-21	World Fishing Contest—Vigo '85
Apr 27-28	Helvetia Contest
Jun 8-9	Worldwide South America CW Contest
Jun 8-9	ARRL VHF QSO Party
Jun 22-23	ARRL Field Day
Jul 1	CARF Canada Day Contest
Jul 13-14	IARU Radiosport Championship
Jul 20-22	CQ VHF WPX Contest
Aug 3-4	ARRL UHF Contest
Aug 17-18	New Jersey QSO Party
Sep 14-15	ARRL VHF QSO Party
Sep 28-29	Late Summer QRP CW Activity Weekend
Oct 5-6	ARRL QSO Party—CW
Oct 12-13	Rio CW DX Contest
Oct 12-13	ARRL QSO Party—Phone
Oct 19-20	ARRL Simulated Emergency Test
Nov 2-3	ARRL Sweepstakes—CW
Nov 16-17	ARRL Sweepstakes—Phone
Dec 14-15	ARRL 10-Meter Contest

THE ARUNDEL HAM NEWS
AARC

NEWSLETTER OF THE MONTH

The Ham Arundel News, edited by Holly Bevan N3BMB and Di Helfrich KA3GWI, takes this month's honors. The *News* chronicles the activities of the Anne Arundel Radio Club, located in Davidsonville, Maryland.

And what activity! I was impressed with the variety of things that the club's members are involved in. Community service, contests, traffic handling; they're all well represented by this group. Several nets during the week on various bands and modes keep everyone's skills honed and add to a feeling of camaraderie that is evident throughout the pages of the *News*.

The newsletter offers a wealth of information from diverse sources in a well presented format. It's obvious that Holly and Di have great pride in their work. Club President Ron Nord N3AKP should take every precaution necessary to ensure that these two stay on the job.

To enter your club's newsletter in *73*'s Newsletter of the Month Contest, send it to *73*, Pine Street, Peterborough NH 03458, Attn: Newsletter of the Month.

4TH ANNUAL RTTY WORLD CHAMPIONSHIP

Starts: 0000 UTC February 23
Ends: 2400 UTC February 23

The contest is sponsored by *The RTTY Journal* and by *73*. The two operator classes are: (A) single operator, single transmitter, and (B) multi-operator, single transmitter. Entry categories are: (A) single band, and (B) allband, 10-80meters. The same station may be worked once on each band. Crossmode contacts do not count. Single-operator stations may work 16 hours maximum, while the multi-operator stations may operate the entire 24-hour period. Off times are no less than thirty minutes each and must be logged.

EXCHANGE:

Stations within the continental US and Canada must transmit RST and state, province, or territory. All others must transmit RST and consecutive contact number.

SCORING:

Five QSO points for contacts with W/VE stations located within the continental US and Canada. Ten QSO points for all other contacts. One multiplier point is awarded for each of the 48 continental US states (a District of Columbia contact may be substituted for a state of Maryland multiplier), Canadian provinces/territories, and DX countries worked on each band (excluding US and Canada). Total QSO points times total multipliers equals claimed score.

AWARDS:

Contest awards will be issued in each entry category and operator class in each of the US call districts, Canadian provinces/territories, as well as in each DX country represented. Other awards may be issued at the discretion of the awards committee. A minimum of 25 QSOs must be worked to be eligible for awards.

ENTRIES:

Entries must include a separate log for each band, a dupe sheet, a multiplier checklist, and a list of equipment used. Contestants are asked to send an SASE to the contest address for official forms. Omission of the required entry forms, operating in excess of legal power, manipulating scores or times to achieve a score advantage, or failure to omit duplicate contacts which would reduce the overall score more than 2% are all grounds for immediate disqualification. Decisions of the contest committee are final.

All entries must be postmarked no later than April 16, 1985, and should be sent to: RTTY World Championship Contest, c/o *The RTTY Journal*, PO Box RY, Cardiff CA 92077.

FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

A HAM SMORGASBORD

The other evening, while working an SM station on 20, I got to thinking about Swedish cuisine. You know, the Swedes have some really wonderful ideas about good eating. Perhaps their best concept is the smorgasbord (second only to Swedish meatballs).

My hamming activities are a lot like a well-prepared smorgasbord, since I'm never content with sticking to just one or two of our hobby's numerous diversions. During my years as a ham I've been involved with DXing, CW, RTTY, SSTV, repeaters, VHF DXing, home-brew construction, emergency work, certificate hunting, and contesting, rarely sticking to one endeavor for more than a few months at a time. That's the great thing about our hobby: If you're the sort of person who has a limited attention span, there's always something new or different to catch your interest.

Which brings me back to the topic of smorgasbords. Writing a monthly column about a single topic within amateur radio can become stifling after a while. One yearns to break free, to write a column that covers the entire spectrum of amateur activities. And that's what I did this month, write a "Fun!" column with something for everyone. A ham smorgasbord, if you will. Enjoy—and good luck.

THE QUESTIONS

1) The first transatlantic QSO took place in:
1) 1901
2) 1912
3) 1918
4) 1923

2) In what year was the Vibroplex "bug" Company established?
1) 1865
2) 1890
3) 1904
4) 1920

3) Which of the following was never a recognized distress signal:
1) CQD
2) SOS
3) QRRR
4) CQE

4) The Top Band is:
1) 160 meters
2) 80 meters
3) 20 meters
4) 70 centimeters

5) Heathkit got its start by making:
1) radio kits
2) "fly it yourself" airplane kits
3) furniture
4) automobiles

6) Ionic scatter is useful over a range of about:
1) 0-50 miles
2) 50-500 miles
3) 600-1200 miles
4) 2000-5000 miles

7) Frequency synthesis:
1) was common in the 1960s
2) uses a variable capacitor
3) is outdated
4) uses digital techniques

8) The lower the frequency:
1) the shorter the antenna
2) the higher the antenna
3) the longer the antenna
4) the thicker the antenna wire

9) The *Popular Electronics* ham-radio columnist in the 1960s was:
1) Stan Burns W1XCT
2) Herb Brier W9EGQ
3) Tom Hanks WB2LWJ
4) Jim Bird WA2MJK

10) The first reciprocal operating agreement was reached with:
1) the United Kingdom
2) Canada
3) Costa Rica
4) Italy

11) About how many members did the ARRL have in 1914?
1) 50
2) 200
3) 2,000
4) 20,000

12) The FCC started issuing WA prefixes in:
1) 1951
2) 1957
3) 1960
4) 1967

13) Another name for a RTTY demodulator is a:
1) modem
2) Teletype®
3) converter
4) generator

14) A radio signal can travel no farther than:
1) 20,000 miles
2) 200,000 miles
3) 20,000,000 miles
4) infinity

15) Transequatorial propagation is usually found on:
1) VLF
2) HF
3) VHF
4) SHF

16) "See you on the green keys," is a saying used by:
1) computer hackers
2) RTTY buffs
3) SSTV enthusiasts
4) CW keyboard operators

17) In what year were Technician-class operators permitted to use 6 meters?
1) 1950
2) 1955
3) 1960
4) 1965

18) "Gray line" propagation is usually found:
1) on a bus
2) at night
3) at sunrise and sunset
4) during solar eclipses

19) Which of the following components is *not* used as a power-supply regulator?
1) integrated circuit
2) zener diode
3) resistor
4) transistor

20) Hallicrafters' popular HT-30 was unveiled in:
1) 1944
2) 1950
3) 1954
4) 1958

21) Which component *cannot* be tested by a volt ohmmeter?
1) integrated circuit
2) transistor
3) diode
4) resistor

22) The first amateur-radio organization—the Junior Wireless Club, Limited, of New York City—was founded in:
1) 1890
2) 1901
3) 1909
4) 1915

23) The US Post Office issued an amateur-radio stamp in:
1) 1934
2) 1954
3) 1964
4) 1974

24) Radio waves in a circuit act like:
1) ac
2) dc
3) FM
4) eddy pools

25) Before the mid-1970s, a "Novice gallon" was:
1) 50 Watts
2) 75 Watts
3) 250 Watts
4) 2 kilowatts

26) A shorting stick is a form of:
1) capacitor
2) resistor
3) transistor
4) safety device

27) A "brag tape" was used by:
1) RTTY operators
2) SSTV users
3) contesters
4) traffic handlers

28) The GERATOL Net:
1) meets on 20 meters
2) is open only to Extra-class hams
3) is only for old-timers
4) meets on Friday afternoons

29) The Coulomb is the unit of:
1) quality
2) quantity
3) inductance
4) capacitance

30) Arizona was once in the:
1) third call district
2) sixth call district
3) first call district
4) zero call district

31) New Jersey was once in the:
1) first call district
2) third call district
3) ninth call district
4) fifth call district

32) How many rectifiers does a full-wave bridge rectifier use?
1) one
2) two
3) three
4) four

33) Back in the 1960s, who used to "sign" every ham ticket?
1) John Q. Public
2) Robert G. Baxter
3) Harry Dannals
4) Ben F. Waple

34) Which of the following government agencies *never* administered amateur radio:
1) Navy Department
2) Federal Radio Commission
3) Army Department
4) Commerce Department

35) What is the current value of an 8-Watt lamp running at 200 volts?
1) 25
2) 0.4
3) 0.04
4) 0.004

36) The top limit for QRP (low-power) operation is usually considered to be:
1) 1 milliwatt
2) 5 milliwatts
3) 1 Watt
4) 5 Watts

37) "73" means:
1) good-bye
2) good luck
3) best regards
4) signing off

38) The 1947 World Administrative Radio Conference was held in:
1) Cairo
2) London
3) Geneva
4) Atlantic City

39) In the 1920s, the ARRL tried to change amateur radio's name to:
1) citizen radio
2) people's radio
3) hobbyist radio
4) technical radio

40) The Geminids meteor shower occurs in:
1) March
2) June
3) August
4) December

41) "Multipliers" are found:
1) in contests
2) in audio stages
3) while DXing
4) rarely

42) Canada adopted incentive licensing in:
1) 1947
2) 1952
3) 1965
4) 1972

43) The term "yagi" comes from:
1) the name of its inventor
2) "Y-match antenna gain impedance"
3) a derivation of "yogi"
4) out of nowhere

44) Lee De Forest invented the audion in:
1) 1900
2) 1906
3) 1915
4) 1920

45) Which of the following terms *is not* an abbreviation for universal coordinated time:
1) UTC
2) GMT
3) Z
4) X

46) The ARRL's Worked All States Award was introduced in:
1) 1928
2) 1936
3) 1948
4) 1957

47) The first ARRL 10-Meter Contest was held in:
1) 1934
2) 1956
3) 1965
4) 1973

48) The "Fun!" column made its debut in:
1) 1965
2) 1977
3) 1980
4) 1983

49) Colpitts oscillators work through:
1) capacitive feedback
2) capacitive strobe effect
3) capacitive amplification
4) capacitive deamplification

50) The Collins KWM 1 was introduced in:
1) 1935
2) 1948
3) 1957
4) 1963

THE ANSWERS

1—4	6—3	11—2
2—2	7—4	12—2
3—4	8—3	13—3
4—1	9—2	14—4
5—2	10—3	15—3

16—2	28—2	40—4
17—2	29—2	41—1
18—3	30—2	42—1
19—3	31—2	43—1
20—3	32—4	44—2
21—1	33—4	45—4
22—3	34—3	46—2
23—3	35—3	47—4
24—1	36—4	48—3
25—2	37—3	49—1
26—4	38—4	50—3
27—1	39—1	

SCORING

Two points for each correct answer.
How did you do?
1-20 points—Have you considered stamp collecting?
21-40 points—Take off the headset
41-60 points—So you like 2-meter FM?
61-80 points—Amateur material
81-100 points—A complete ham

HAM HELP

I need service information or parts for several pieces of equipment. I will copy the information and return it. Here's the list: EIP model 350C Auto Het frequency counter, 20 Hz to 12.4 GHz; Panasonic model RF2800 AM/FM/SW receiver (the AM section is dead; it needs a bandswitch and a whip antenna); Simpson model B 16-channel VHF transceiver; R. L. Drake R4B receiver; Midland model 13-955 CB; Lafayette model RK-825 reel-to-reel tape recorder. Thanks!

Mike Adams N4EVS
6333 Hwy. 2321
Panama City FL 32404

I would like to know the day, time, and frequency of the IBM PC Users' net on 20 meters.

Gail L. West WA4ASB
6605 SW 113 Ave.
Miami FL 33173

I recently purchased a Xerox model TC400 telecopier and would like to use it for weather-satellite reception and to receive facsimile signals from my shortwave radio. Unfortunately, the TC400 has a drum speed of 180 rpm, which is not compatible with the 120 rpm used in radio work. Has anyone successfully converted this unit to 120-rpm service?

Philip Nash
27 Highview Place
Kitchener, Ontario
Canada N2N 1W8

I am in search of a construction/alignment manual for the Conar model 255 oscilloscope. I will pay a reasonable price for the original or a photocopy.

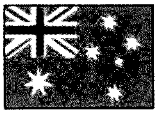
Robert Whitted DA2EB
PO Box 2567
APO NY 09123

See List of Advertisers on page 80

73 INTERNATIONAL

Each month, 73 brings you ham-radio news from around the world. In this collection of reports from our foreign correspondents, we present the latest news in DX, contests, and events, as well as keep you abreast of the technical achievements of hams in other countries.

If you would like to contribute to your country's column, write to your country's correspondent or to 73: Amateur Radio's Technical Journal, *Pine Street, Peterborough NH 03458, USA, Attn: Perry Donham KW1O.*



AUSTRALIA

J. E. Joyce VK3YJ
44 Wren Street
Altona 3018
Victoria
Australia

STOP PRESS—FIRST TIME EVER VI3 PREFIX

To celebrate Victoria's (VK3) 150 years of settlement, our WIA Executive applied to our DOC for a special callsign prefix, expecting to get the usual AX prefix. Everybody was elated when our DOC granted, for the first time ever, the use of the VI3WI callsign.

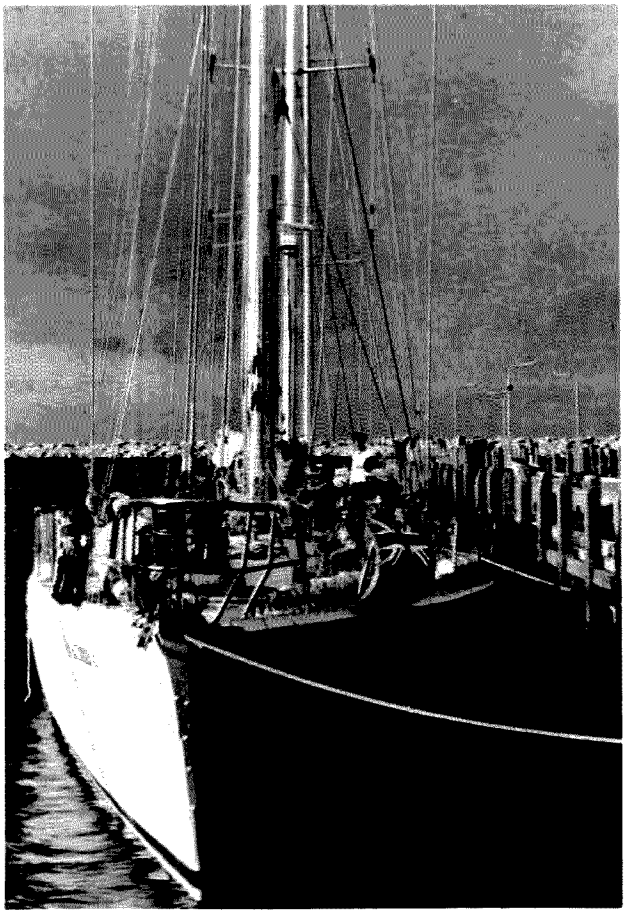
This should please the prefix hunters as it will be in use by selected clubs and individuals only and, to guarantee QSL cards, the WIA (VK3 Division) has taken on the QSLing for this special event. All contacts will receive a QSL card via the bureau and those wishing a direct card are being catered to also. The card itself will feature a special "Victoria Growing Together" logo.

The use of this special callsign is granted from November, 1984, until April, 1985, and there also is an award involved. (Details are in the November, 1984, issue of *73*, page 90.) The address for either a direct QSL with appropriate IRCs (US$2.00) or the award is Vic 150 Years Award, c/o W.I.A., 412 Brunswick Street, Fitzroy 3065, Victoria, Australia.

BIG BEN—THE WHITE VOLCANO

Shown nationally in prime viewing time on our TV Channel 2 Network recently was the documentary film of the VK6-organized expedition to Heard Island. The title of this documentary was "The White Volcano."

Lots of articles have been written concerning the two expeditions to Heard Island, but nothing written could compare with this beautifully filmed documentary. It starts off as the expeditioners are boarding the yacht *Anaconda II* in Perth, West Australia. As the expeditioners are to form part of the crew, it shows the boat's owner/skipper, Josko Grubic, training them in all aspects of handling this magnificent yacht under all conditions—60-knot winds and massive southern ocean waves included.



The yacht Anaconda II.

Your first impression of Heard Island is of magnificent isolation, but the feeling of isolation disappears when the film shows the wreckage of what was an Australian Antarctic Research Station. Particularly piquant are shots of the leftover boiling pots of those "sealers" who, in the late 1800s, reduced the local seal population from millions down to virtual extinction. Penguins and sea birds were also virtually wiped out.

Landing and Operating

The method of landing equipment at Atlas Cove is of particular interest. They used "rubber-ducky" type boats and charged at the rock and pebble beach; when they hit the beach, one man would jump out and throw out all the gear he could before the next wave took them off the beach again.

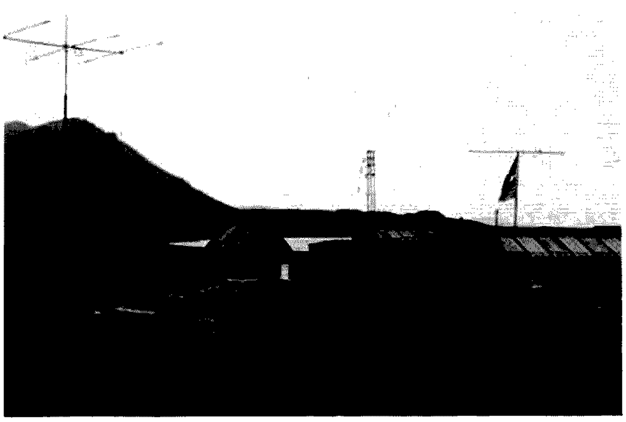
With the howling gales that are virtually a daily occurrence on Heard Island, the shots of the people raising the amateur antennas were interesting, considering that the wind blew the tribander down and bent it shortly after erection.

There was some good footage of Dave Shaw VK3DHF/VK0HI and Al Fisher K8CW/VK0CW making their first contact from Heard Island. This was with Hugh VK6FS, with Hugh giving a short speech of thanks to the expeditioners and wishing them luck.

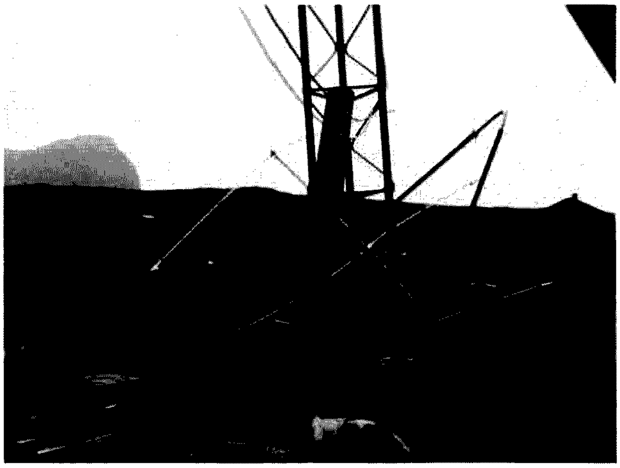
Some excellent film was shown of the climbers conquering "Big Ben," the White Volcano. One shot in particular shows that the last access to the top of Big Ben is through a tunnel leading upwards through the mountain. While all outside the tunnel is ice and snow, the inside walls of this tunnel are quite warm to the touch.

As this documentary has already been shown on some TV stations in Asia and Europe, it could soon be released for viewing in the USA. With this in mind, I personally recommend this film. Not only is it good viewing for the amateur-radio content to show how a DX expedition should be planned and carried out, but because it shows one of our seldom-filmed remote land masses.

With over 30,000 contacts logged by only two amateur-radio operators under adverse weather and band conditions, the expedition was very successful, as was the conquering of Big Ben by the mountain



The base at Atlas Cove, Heard Island. Note the Australian and American flags on the antenna.



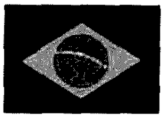
The tribander shortly after it went up: It was blown down. Again.

climbers, the scientists with the expedition also concluding their tests satisfactorily. Thus the VK6-sponsored expedition to Heard Island was a complete success, as proved by this splendid documentary film.

With the enormous amount of planning and cost to mount this type of DX expedition, I feel it will be a long time before any amateurs in VK think about going back down to Heard Island, the home of the White Volcano.

SILENT KEY

Hugh VK6FS (or 6 Flying Saucer as he liked to be called) has since become a Silent Key. Hugh, who was one of the leading figures in organizing the above expedition, and their first contact from Heard Island, will be sadly missed by his many regular on-air contacts worldwide.



BRAZIL

Gerson Rissin PY1APS
PO Box 12178 Copacabana
20000 Rio de Janeiro, RJ
Brazil

THE PLEASURE OF BEING AN AMATEUR

This has been told by Joao Havro PY5AVR, and it shows how an unexpected QSO suddenly opened a new horizon for his life.

It was during the month of April, 1981. Joao did not expect he would have such a great surprise on that day, when on 14.030 MHz he heard a call of Edmund Gorecki SP2WI from Gdynia, Poland. Immediately he remembered his grandfather, Luis Havro, who lived for many years in Gdynia. Luis belonged to the Navy and because of the war came to Brazil, leaving behind his brother, Joseph. Arriving here, he always tried to keep in touch with Joseph, but all in vain.

Joao recalls that his grandfather always used to tell stories about the family and his country. These tales stayed forever in his memory, including details and names of small towns. For this reason, he was very moved to hear Edmund. Joao could not refrain from asking if Edmund knew any family with the last name of Havro.

With the strong brotherhood which exists among amateurs, SP2WI at once offered to inquire if there still existed any remainder of the family in town. He asked for a delay of one week, after which he would make a new contact. On the appraised date and hour, with all skill and practice acquired after many years, Havro turned his equipment on and began to call Edmund Gorecki.

It did not take him a long time to get in touch, and to the joy of Havro and all his relatives, Edmund confirmed that he had found a person named Henrik Havro, a grandson of Joseph and therefore a cousin of Joao.

Until then, Joao did not know he had a relative in Poland, and when the first letter from Poland arrived it waa impossible to hold back the tears when he held in his hands the letter of a cousin he never dreamed could exist. In the letter, Henrik invited Joao to visit him. Many letters were exchanged between them. And after many preparations and with the kindness of Pan American where he worked during twenty-five years and who granted him a reduction of 50% in the ticket, Joao got on a plane on September 11th.

He visited Miami Beach, traveling afterwards to New York, Frankfurt, and finally to Varsovy (Warsaw). In Varsovy, capital of Poland, center of the country's cultural life and also an important industry center, he stayed for a few days and then continued his trip by train to beautiful Gdynia. The handsomeness of the harbor town, scenery of most of the stories his grandfather used to tell him, soon charmed Joao. Henrik and his wife Irena spotted Joao at the railway station by using pictures of him. The meeting was full of emotion, and the tears were a sign of the great satisfaction they all felt for the realization of a dream which came true.

When they arrived at home, Adam and Klaudiusz, sons of Henrik and Irena, soon introduced themselves. As Joao did not speak Polish, the communication among them was possible only through Irena and her two nieces, Katarzina and Barbra, who spoke flawless English.

Joao stayed there approximately a month. During this time, he got to know Gdansk, where an important dockyard stands, and Sopot and Oliwa, which for their climate and elegance are important tourist centers. He also had the opportunity to visit several well-planted farms. About the Polish people, he remarked that they are devoutly Catholic, dedicated to work, and helpful. There are no slums and no beggars walking on the streets.

With martial law, the Polish government had the transmitters of all radio amateurs sealed, but now they are operating again. And thanks to ham activity, great things may be carried out. Happenings like this stimulate continuation and the propagation of more wonderful things which cross frontiers and spread throughout the world.

Joao's true story reminded me that I could have this same happiness. My father is a Russian, born in the Ukraine in 1914. He came to Brazil when he was only nine years old, together with two brothers older than him. Our family's name is Rissin, and it is not a common name in Russia. My father says that relatives of his father's brother went to America at the same time he came to Brazil. So, if you want to help me, take a look in the phone book of your city and try to find any Rissin there. During trips to the States I have searched in Miami, New York, Orlando, Las Vegas, Los Angeles, San Francisco, and Honolulu, but all in vain. I found a Rissin Jewelry in New York City, but in spite of the Ukrainian background of the owner, he was unable to establish our relationship. I'll be happy to tell you also my story if I do find my own relatives!

CZECHOSLOVAKIA

Rudolf Karaba (OK3KFO ARC)
Komenskeho 1477/8
955 01 Topolcany
Czechoslovakia

CRC, PO Box 68, 113 27 Praha 1, Czechoslovakia, is giving this award: *The Slovensko Award* is issued by the OK3 DX Club of Radio Amateurs of Slovakia to all licensed amateurs who provide proof of contact with stations working in different districts of Slovakia: OK3, OL8, OL9, and OL9 (districts listed in Fig. 1) after January 1, 1946, as follows:

(1) Stations in countries abutting on Slovakia (SP, UB, HA, OE) need 35 districts;

(2) Stations in other European countries need 20 districts, and

(3) DX stations (also USA), 10 districts.

No band or mode restrictions. Not available for SWLs. Applications with GCR list and a fee or 10 IRCs may be sent to CRC. List of districts is in Fig. 1.

POINTS OF INTERESTS:

OK3CAQ made contacts for WAC when operating SSB on the 3.5-MHz band in the night of May 8-9, 1984. These contacts had been made in the course of 3 hours from the radio club OK3KFY in Stupava with the transceiver Otava (70 Watts input) and the W3DZZ antenna: 2312 UTC—VK6LK, 2334—EA9KF, 0020—EI2L, 0026—AP2ZR, 0058—CP1ES, and 0214—VE2RL.

On July 31, 1984, died one of the pioneers of amateur broadcasting and the best Czechoslovak DX-man, Vladimir Kott OK1FF.

On OSCAR 10, mode B, after a long time, another radio ham appeared. It is Jan OK2EH.

Annually in Czechoslovakia, the shortwave championships have been held in these categories: individuals, radio clubs, OL stations (youth up to 18 years), and listeners. The best station in each category gains the title of the champion of Czechoslovakia. For the championships, the first 20 stations in each category and three best placements of these contacts have been recorded: CQ WW DX Contest—CW, CQ WW DX Contest—SSB, WAEDC—CW, WAEDC—SSB, IARU Championship, and the OK-DX Contest.

NEW WORLD RECORDS

At the end of May, 1984, a new world record on 24 GHz had been gained by the operators of stations I4CHY and IW3EHQ/I3SDY by their contacts for the distance of 289 kilometers between locators GD44b and GG72j. Both the stations had used transmitters with inputs of 100 milliwatts from Gunn oscillators and receivers with a noise figure of 5.5 dB.

Another world record has been made by the operators of stations DL1CR and DL3ER from Munich, who, in the 47-GHz band, had overcome the distance of 13 kilometers and had used a parabolic antenna with a diameter of 9 centimeters and transmitters with inputs of 0.5 mW.

RTTY

OK1DRX has worked out some programs for CW and RTTY for ZX-Spectrum. The computer is directly working out and generating a low-frequency signal without any further technical equipment necessary.

Banska Bystrica	Poprad
Bardejov	Povazska Bystrica
Bratislava	Presov
Bratislava-vidiek	Prievidza
Cadca	Rimavska Sobota
Oolny Kubin	Roznava
Dunajska Streda	Senica
Galanta	Spisska Nova Ves
Humenne	Stara Lubovna
Komarno	Svidnik
Kosice	Topolcany
Kosice-vidiek	Trebisov
Levice	Trencin
Liptovsky Mikulas	Trnava
Lucenec	Velky Krtis
Martin	Vranov
Michalovce	Zvolen
Nitra	Ziar nad Hronom
Nove Zamky	Zilina

Fig. 1. Districts in OK3 and OK8-0.

INDIA

Amar N. Banerjee VU2CZ
Amateur Radio Society of India
PO Box 3005
New Delhi 003
India

NEWS FROM INDIA

Mr. Rajiv Gandhi (age 40 yrs) became the Prime Minister of India in the evening of 31 October, 1984. He passed the 1st Grade amateur examination in 1974 and was allotted callsign VU2RG on 1st January, 1975. Ever since, he remained active generally on 21/28 MHz and added activity on 144-146 MHz in the past two years. His interests during and after school days remained with aviation and electronics. He was a keen home-brewer in electronics, and witnessing amateur radio in action (at the OTH of his uncle), he started taking training in amateur radio in 1974. Just after obtaining callsign VU2RG, within 3 months, he made his first home-brew HF CW/SSB transceiver and a two-element cubical quad antenna. He used this setup till 1980, making a large number of contacts. He printed two different QSL card designs in the course of 5 years and constantly dispatched outward QSL cards via the ARSI QSL Bureau, New Delhi.

After he became a Member of Parliament (Lok Sabha: Lower House) in June, 1981, and till today, he was constantly working for progressive developments in

The Slovensko Award.

aviation and electronics, including amateur radio. It is due to his constant efforts that computer training will percolate in school levels in India hereafter, that several aids have been given to the electronic trade/industry, and that the government of India is now seriously considering easier import rules for computers. In summer vacation, 1984, he trained his 14-year-old son Rahul Gandhi on computers. In amateur activity, he took up the cause of amateurs individually or collectively, organized emergency amateur participation to maintain communications during cyclone and flood disasters in Western India at times when all known channels of civil communications failed, and persuaded the government of India to consider the request of the ARSI to allow custom-duty-free import of amateur equipment, accessories, and components. Such facilities are now available in favor of each amateur in this country till 31 March, 1985.

During 1975, his wife, Mrs. Sonia Gandhi, passed the 1st Grade amateur examination at New Delhi and was allotted callsign VU2SON, and she too remained active all these days on 21/28 and 144-146 MHz. In 1984, VU2RG and VU2SON induced their son and daughter, Priyanka Gandhi (12 years old), to get trained in amateur radio. Amar VU2CZ, who trained VU2RG/SON earlier in 1974/75 and is training Rahul and Priyanka in 1984, is hopeful that by January, 1985, the two children will be on the air. Amateur radio was/is a quality way of life, and part of it now is in the Prime Minister's residence.

Rajiv Gandhi was very enthusiastic about the New Delhi visit of Noel Eaton VE3CJ, president of the IARU, in March, 1975, and the then-Prime Minister, Mrs. Indira Gandhi, met Mr. and Mrs. Eaton at the QTH of VU2RG. A photograph of the meeting appeared in *QST* later. Like our beloved Indira Gandhi, who served for unification of world, VU2RG's feelings are in the same direction, as is evident from the fact that he displayed the amateur-radio poster titled ONE WORLD—ONE LANGUAGE at the two exhibitions on amateur radio at New Delhi (meant for school children) at the entrance of the exhibitions; many times that poster in miniature size got displayed in his car. (The stock of that poster may be exhausted now.) Similarly, the ITU posters of WCY 1983 were displayed in his office, which used to receive at least 500 visitors every day belonging to all walks of life from all over India.

The amateur station of VU2RG/SON happens to be the foremost in this country, and VU2RG is all the time endeavoring to keep abreast of modern technology and developments in amateur radio. The number of amateur-radio journals read by him surpasses that read in the ARSI. Any new development in amateur-radio technology published in any non-IARU journal is eventually sent by him to the ARSI for reading and return. On October 23, 1984, he spoke to Amar VU2CZ to find out details of accessories required further for Amateur Radio Computer Network (packet radio) to suit his HF transceiver, FT-1, and VHF transceiver, TR-7850, and was equally enthusiastic to incorporate, if feasible, the DCS (Digital Coded Squelch) system in place of CTCSS in his TR-7850 or TR-2500. In July, 1984, he was granted permission to install a "closed repeater" in the amateur VHF service (144-146 MHz) with callsign VU2RRG. The equipment is awaited from abroad, and when installed will be the first amateur repeater (relay) station in India and the first really sophisticated amateur repeater in Asia. He has not yet turned his eyes towards amateur satellite communications and it is appropriate that we try to introduce his two children to this field. It may not be out of place to mention that apart from being the Prime Minister, he holds the additional portfolio of being the Minister for the Department of Electronics.

For further coordination, all are requested to keep the Amateur Radio Society of India (ARSI) informed about any message or news published in this context or any equipment details that are proposed to be sent to VU2RG. In view of the fact that he has presently very busy schedules and the country's General Election is forthcoming, we are not sure as to how much it will be possible for him to respond to communications from amateurs, but no communication sent to him is likely to remain unnoticed. To us, VU2RG represents the spirit of dedication and achievement.

LIBERIA

Brother Donard Steffes, C.S.C.
EL2AL/WB8HFY
Brothers of the Holy Cross
St. Patrick High School
PO Box 1005
Monrovia
Republic of Liberia

AMATEUR RADIO IN LIBERIA

The Mano River flows from the northeast, forming part of the northern border of Liberia. It marks a section of the edge of Sierra Leone to the south and empties into the Atlantic Ocean some forty miles to the southeast. As rivers go, it is not impressive, but during the torrential tropical rains of Liberia it can grow to a formidable size in a short time.

Liberia has at least four sites where iron ore has been found and mined. Two of these sites have been depleted so that the financial returns from the mining operations are marginal. Bong Mines is one of the sites where the deposits are so poor that the ore has to be separated from the rock and pelletized before it can be shipped. Six of the members of the administrative staff are amateurs, and they maintain a two-meter repeater which is accessible from Monrovia.

In the Mano River area there is another mine which is very extensive in the land that it covers. The ore is deposited in scattered pockets so that a lot of road building is required. When one of these pockets is located, the topsoil has to be pushed away so that the ore can be scooped up and hauled to the crusher. After that it is washed and finally they have a product that is sixty-seven-percent ore.

This washing requires vast amounts of water. As nearly as I can ascertain the situation, the National Mining Company built a kind of a natural reservoir on the side of one of the hills just above the Mano River to serve as a water supply for the mining operation. Along the opposite side of the river the terrain was more flat, somewhat fertile, and with the river nearby it seemed an ideal spot to build homes. Gradually a residential community grew up in that area with homes that were quite substantial and permanent.

I have not been able to collect all the historical data, so it is not clear just how many years this little community flourished. It was in my second year in Liberia that the disaster struck. It was at the height of the rainy season and the rains seemed to be extraordinarily persistent and heavy. The whole earth was saturated with water and the whole side of the mountain let go. They called it a mud slide. The whole land mass along with the water from the reservoir slid down the hill, across the river and inundated the homes. It was sudden and without warning.

The amateurs were not there.

It would be nice to write a glowing account of heroic amateur activity but there is none to write. There were two amateurs present at the disaster, but both of them being doctors, they were occupied with things other than amateur communication.

Our faces are red and we feel very badly but we have lots of excuses. Even if we had had the necessary field equipment, it is doubtful that we could have reached the Mano River disaster area. The road out of Monrovia is blacktop, but when it reaches Bomi Hills the pavement terminates and from there on it is laterite, and during the rainy season it becomes very difficult.

This whole story is the result of a recent visit to Mano River and the mining operation. Three of us (amateurs) drove up to give an examination for an amateur license. It was a four-hour trip one way and there were times when we were not sure that we should continue. We did make it, however, and it is another experience which this amateur will not soon forget.

We visited the mine and we visited the site of the disaster. The excavated walls and foundations were a stark reminder of the reality, and the beautiful little cemetery with its monument to preserve the names of the victims lent credence to the story of what had taken place. We have spent much time and effort to formulate a practical plan which can be implemented so that we will be ready should the need arise again; we do not have a plan yet.

The history of amateur service in Liberia does have brighter spots. The Lassa Fever epidemic is one. The amateurs, in that emergency, set up international communication which, in great measure, helped to bring the epidemic under control. On a lesser side, our doctors routinely use amateur radio to advise each other and to advise medics who find themselves confronted with a serious problem up in the bush where there is no doctor available. Both of these amateur activities have been described in this column.

Amateur radio in Liberia is progressing. The standards are high. There is goodwill and cooperation, and while we are not batting a thousand in the field of effort, we are probably batting over five hundred—which is really not too bad.

MEXICO

Mark K. Toutjian XE1KMT
Apartado Postal 42-048
06470
Mexico, D.F.

NEWS IN MEXICO

No doubt you heard the news about the horrible explosion and fire in the Mexico City suburb leaving hundreds dead, over 1500 wounded, and thousands homeless. Of course, line communication to that particular area was automatically wiped away, leaving a tremendous task for government agencies—and yes, ham-radio operators on both two meters and HF. The National Emergency Network was busy for days on those bands! We can certainly appreciate the effort of local and national hams as well as aid given by the US when most needed.

CAPABLE VOLUNTEERS IN MEXICO?

A station in Mexico that could serve as a gateway into the North American Teleconference Radio Net (TRN) is needed. The purpose of TRN is to provide high-quality education and informational programs of interest to all amateurs.

Most of the gateway stations in Canada and the US are VHF repeater stations. However, we believe an HF station would be more appropriate to provide wide-area coverage in Mexico. All that would be required at that station is a phone patch and the ability to initiate a call into the teleconference bridge in the US (probably Minneapolis, Minnesota). Or it might be possible to arrange a radio relay from the US, although this approach would probably strain audio quality and make it difficult to provide two-way interaction with Mexican amateurs and the featured speaker on the net.

Please contact me as soon as possible if you think you have a station that could serve as a gateway (tie-in station with two-way capability) in Mexico. Your comments and suggestions regarding the applicability and interest in the TRN in Mexico will also be appreciated. If you have a telephone number at which you may be reached during the day, please send this along as well.

This would be a great opportunity for Mexican amateurs to get in on discussions with full two-way contact with the featured speaker and be able to get many of their questions answered. Of course, participants from Mexico could give their own suggestions and make their interesting comments. It is expected that 75,000 amateurs will be tuned into the net!

Stations are tied together by dialing into a teleconference bridge. Each participant must bear the cost for the long-distance call. It is desirable to defeat the time-out timer on the autopatch during the net to obviate the need for constant kerchunking during the one to two hours that the net may run.

The teleconference bridge that is being used is the Darome model 2020 "Co-Convenor." This is the most sophisticated multi-point teleconference bridge available to the public today. Most participants will use a bridge owned by the Darome Connection in Chicago for the next net. This will give you some idea of the cost for the call into the bridge from your location.

If you are in Mexico, contact me personally. If you are not, then please write to: Richard A. Whiting WØTN, TRN Net Manager, Honeywell Amateur Radio Club, 4749 Diane Drive, Minnetonka MN 55343; his work phone: (612)-870-2071.

We look forward to opening up this opportunity to amateurs here throughout Mexico towards the further advancement of amateur radio!

VENEZUELA

Luis E. Suarez OA4KO/YV5
Apartado 66994
Caracas 1061-A
Venezuela

Circuito 3 (call area 3) is made up of the states of Lara, Yaracuy, and Portuguesa. The capital city of Lara is Barquisimeto, the largest city of the country after Caracas, Maracaibo, and Valencia.

It is said that Barquisimeto was founded in 1552 by Juan de Villegas. However, he named the city Nueva Segovia. In fact, he came to the area not to found a city but to develop the mines of Buria, discovered earlier by a compatriot. The town was destroyed by the slaves when they revolted;

the Spaniards escaped and founded a new city near the Turbio (turbid) river. They still called the town Nueva Segovia, but since the Indians called the river by their word for turbid, Barquisimeto, that's why the city was finally so called. This happened 10 years after Juan de Villegas died.

Lara state has been almost exclusively an agricultural settlement. Actually, the landscape is arid but the valleys of the Turbio and Tocuyo rivers have produced sugar, potatoes, tomatoes, onions (and goats) since then. Nevertheless, nowadays Barquisimeto is a large industrial area that is growing to the north of the city.

Barquisimeto is very well designed. All calles (streets) run from south to north while carreras (avenues) run east to west. On the even-numbered carreras, traffic flows west and on even-numbered calles, the traffic flows north. However, the numbering is a bit cumbersome. For example, the address, Carrera 18 No. 25-23, means a place on Carrera 18 located some 23 meters from Calle 25 in the block situated between Calle 25 and Calle 26.

The best repeater site in Barquisimeto is Terepaima Mountain, but it is not the only one in the area—there is also Loma Leon, not so high but it has many repeaters installed. At the beginning of this year, several repeaters were stolen from Terepaima. This caused a massive moving to Loma Leon, where the local police have a repeater site. However, I have talked with a friend who has some investment in Terepaima and he assured me that it is safe nowadays.

Yaracuy State

San Felipe, the capital city of Yaracuy, is some four hours from Caracas. It is located midway on the Barquisimeto-Puerto Cabello railroad. It was originally named San Felipe El Fuerte (Saint Phillip The Strong) and founded by Royal decree on November 6, 1729, to be the commercial and administrative center of this region (now Yaracuy State). Venezuela was at that time the world's main producer of chocolate and Spain was the chief consumer. On March 26, 1812, the city was destroyed by the strongest earthquake this country has ever known. The destruction was so complete that the ruins were left undisturbed and a new town was built to the north. Today, San Felipe is a good-looking city with many boulevards and nice suburbs.

Aroa is 77 km north of San Felipe. This place is well known for the gold and copper mines. It is located near the Yurubi National Park, which was created to protect all the mountainous areas which feed the Yaracuy river. The very first copper mines were owned by the family of Libertador Simon Bolivar. In 1977, the National Institute of Parks created the Aroa Mines Park. The old cemetery and some houses were restored, and there is part of the old railroad and smelter. The crushers and the main galleries of the mine itself are 3 km up the gorge. The old bridges look dubious but carry the weight of the school buses that bring students to this area. From the crushers you may walk up to the old colonial Spanish residential camp and to the old English company house that sometime during 1832 administered the mines while Simon Bolivar stayed in London.

Portuguesa State

The capital city of this state is Guanare, a small town founded in 1591 by Captain Juan Fernandez Leon. For years the constant incidence of malaria and cholera deterred the growth of this city. It was only after 1913, when the malaria was eradicated, that this area became a prosperous agricultural center. (Many people think that the capital of this state is Acarigua, a small town with some 6000 inhabitants in 1950 but 100,000 today; it is the largest city of Portuguesa State.) As with the rest of this territory, Acarigua's economy is based on agriculture. The city of Araure is so close to Acarigua that it is almost the same city.

Jose CT1BNK operating the CNE-46 JOTA station.

Southwest of Acarigua is located the Rockefeller Palo Gordo Ranch, a place bought in 1955 by Nelson Rockefeller. The 2000-hectare ranch (800-plus acres) is used to operate a technical assistance program, with three divisions of agricultural research in cooperation with the Venezuelan government. The industrial division mills its own and other people's rice, sesame, and corn, and has a storage capacity for some 7 million pounds of rice. The animal division breeds Santa Gertrudis cattle which are sold for breeding stock. (The Santa Gertrudis, bred on the King Ranch in Texas, were the first breed of cattle developed in the western hemisphere specially suited to resist dry seasons or dry grass.) The third division grows rice under irrigation for seed, all of which is sold in Venezuela. The foundation strains for this new variety of rice came from the Ministerio de Agricultura y Cria, the Rockefeller and Ford Foundation rice research in the Philippines which developed the strains of rice that have produced the "green revolution" in the Orient.

As you can appreciate, the largest city in the area is Barquisimeto and hence has the largest number of amateurs, followed by San Felipe. Being mountainous, there are several repeater sites and hams are linked by 2-meter FM. From any place in the area you may get in contact with all the rest of the country except for the plains south of the Orinoco river.

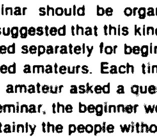
More on Maps

Yes, I like city maps and will continue to exchange maps of Caracas with all fellow hams who send along a map of their cities except, this time, the following, of which I now have too many: Panama City, New York, Los Angeles, Miami, Dade County (FL), Oregon, Livermore, Portland, and Quito (Ecuador). (Also have received some highway maps that I appreciate, but remember that my request is for city maps. Please don't send souvenir or sightseeing maps.) Rand McNally preferred but Dolph's is OK. None received from Europe and Asia. Have none of any city of NH.

Seminar on Satellites

Sponsored by the Asociacion de Radioaficionados de Venezuela (ARV), a seminar on satellites was held last October 27. I was invited to address it and I did, on the history of radio amateur satellites. More that 100 hams were present at the Universidad Central de Venezuela, where the event took place. There is great interest in this facet of amateur radio and I feel that a new seminar should be organized, although I suggested that this kind of event be prepared separately for beginners and experienced amateurs. Each time an experienced amateur asked a question during the seminar, the beginner went into a daze. Certainly the people without experience in space communications get lost, too, during too technical discussions, and interest drops. So far I have gathered some material on satellites, and I'll be pleased to organize, with others' help, a new event of this kind. In the meantime, the next ARV seminar was to be on HF antennas, in January.

The assistance of Edgar YV5ZZ was invaluable during the seminar. He is very active on OSCAR 10 and also a recognized moonbouncer. It is a delight for any aficionado to make a visit to Edgar's home. He has a big stack of 16 yagis for 432 MHz in his garden and another stack for 144 plus HF on the roof. The radio shack is a cornucopia of communications equipment and computers. He has the WAC award on 432-MHz EME with 55 contacts, the very first in Latin America on 70 cm. Now he is planning a 3-meter parabolic to go higher in frequency.



PORTUGAL

Luiz Miguel de Sousa CT4UE
PO Box 32
S. Joao do Estoril 2765
Portugal

On the 20th and 21st of October of 1984, the XXVII Annual Jamboree On The Air (JOTA) took place around the world and, among other things, it created a good opportunity to exchange messages and establish communications among several Scout Associations.

For many years Portugal has been one of the leading countries in this annual event, thanks to the good receptivity and understanding of the Portuguese and foreign hams living here, as well as the local authorities.

A few weeks before the event, we saw great acitvity in choosing the best spots for antennas, ham rigs, etc. So Senior Aspirants, Wayfarers, Head Masters, and also some Explorers didn't waste time. After some hard work fixing a couple of clamps into the wall of an old house serving as a Scout Headquarters for CNE-46 (CNE stands for *Corpo Nacional de Escutas*), we finally had found a nice place for a dipole-duobander 2BDQ for 40 and 80 meters.

A self-supporting tower was made, and on the top of that we had a mini-quad HQ1 for 10, 15, and 20. Jose Reis CT1BNK loaned his rig, a Kenwood TS-520SE, for HF and an FT-221R for VHF. He was active for about 48 hours, that is, Saturday and Sunday. The antennas had been mounted on Friday night, and they just finished at 23:30 GMT.

At 0000 we heard a few hundred stations on 80, and for the first time since its foundation, CNE-64 in Cacem had the first JOTA from its own headquarters.

It may be of interest to you that some of the boys did not realize the simplicity of saying hello to New York City, Johannesburg, Brasilia, or Mexico City, using that skeleton on the top of the tower and a small rig such as the one that we had. I won't comment on some of their expressions (HI)!

After a brief speech about the hobby and the reason for our presence there, CT1BNK didn't leave his TS-520SE, so a good score was made on 80 and 40. Things on higher bands were not very good, but they worked some Brazilian stations on 20 at dawn. At daylight, signals from all over Europe were very strong and loud on 20, 15, and 10 meters, too. France, England, Malta, Italy, Spain, the Canary Islands, the Azores, and Madeira were the best signals in our log book. However, we worked a couple of stations in South Africa, South America, the USA, and Canada. In their messages, the Scouts usually exchanged their addresses for future correspondence, new ideas.

As a result of this operation, next year we should hear some of the boys using their own callsigns since a few showed interest in preparing the papers for their first ticket. This promises another good or an even better operation for the coming year. As a matter of fact, five members were elected to form a ham-radio department (and, of course, I will give them all the support I can).

Every year we do work for the CNE-75 (Estoril Headquarters) located in the heart of this well-known village. Pinto CT4DZ, Jose CT1BNK, and Mike CT4UE are the hams who usually work with that group. On the XXVI Jamboree (1983) they had the special callsign, CT5EST. This year, however, due to the late opening of the activities in CNE-75, they were out of business, but next time they will be well represented, too.

Interest in this nice hobby is not as big as it should be due to a couple of barriers we all face at the beginning. Believe it or not, an SSB transceiver costs over US$1,700, which is too much! Don't believe it? What about a TH6DXX at US$590, a Commodore 64 at US$700, and a hand-held 2m transceiver at US$392? The wine is cheap, but these crazy things (as my girl friend says) are absolutely untouchable.

That's all, folks; 73 from Estoril.

DEALER DIRECTORY

Culver City CA

Jun's Electronics, 3919 Sepulveda Blvd., Culver City CA 90230, 390-8003. Trades 463-1886 San Diego, 827-5732 (Reno NV).

Fontana CA

Complete lines ICOM, DenTron, Ten-Tec, Mirage, Cubic, Lunar, over 4000 electronic products for hobbyist, technician, experimenter. Also CB radio, landmobile. **Fontana Electronics, 8628 Sierra Ave., Fontana CA 92335, 822-7710.**

San Jose CA

Bay area's newest amateur radio store. New & used amateur radio sales & service. We feature Kenwood, ICOM, Azden, Yaesu, Ten-Tec, Santec & many more. **Shaver Radio, Inc., 1775A S. Winchester Blvd., Campbell CA 95008, 370-6665.**

New Castle DE

Factory Authorized Dealer! Yaesu, ICOM, Ten-Tec, KDK, Kenwood, AEA, Kantronics, Santec. Full line of accessories. No sales tax in Delaware. One mile off I-95. **Delaware Amateur Supply, 71 Meadow Road, New Castle DE 19720, 328-7728.**

Preston ID

Ross WB7BYZ has the largest stock of amateur gear in the Intermountain West and the best prices. Call me for all your ham needs. **Ross Distributing, 78 So. State, Preston ID 83263, 852-0830.**

Littleton MA

The reliable ham store serving NE. Full line of ICOM & Kenwood. Yaesu HTs, Drake, Daiwa, B&W accessories. Curtis & Trac keyers. Larsen, Hustler, Telex/Hy-Gain products. Mirage amps., Astron P.S., Alpha Delta protectors, ARRL & Kantronics instruction aids. Whistler radar detectors. Full line of coax fittings. **TEL—COM Electronic Communications, 675 Great Rd. (Rt. 119), Littleton MA 01460, 486-3400/3040.**

Derry NH

Serving the ham community with new and used equipment. We stock and service most major lines: AEA, Astron, Azden, B&W, Cushcraft, Hy-Gain, Hustler, ICOM, Kenwood, KLM, Larsen, Mirage, Mosley; books, rotors, cable and connectors. Business hours 9–7 Monday through Thursday, and 9–5 Friday and Saturday. **Rivendell, 68 Warner Hill Road, Derry NH 03038; 434-5371.**

Albany, New York UPSTATE NEW YORK

Kenwood, ICOM, Ten-Tec, Belden, Cushcraft, Larsen, Hustler, ARRL, Hy-Gain, B&W, MFJ, Mirage. New and used equipment. Serving the amateur community since 1942. **Adirondack Electronics, Inc., 1991 Central Avenue, Albany NY 12205, 456-0203** (one mile west of Northway exit 2W).

Columbus OH

The biggest and best ham store in the Midwest featuring Kenwood and other quality products with working displays. We sell only the best. Authorized Kenwood service. **Universal Amateur Radio, Inc., 1280 Aida Dr., Reynoldsburg (Columbus) OH 43068, 866-4267.**

Dallas TX

IBM PC/XT kits, supplies, expansion products; video restorer kits for pay TV, CATV, satellite hobbyists' electronic project kits/appnotes. More than 9000 parts in stock: semiconductors, ICs, discretes, video accessories, tools, audio, automotive, cabinets, computer peripherals. Please write for your free 60-page catalog: **Sabet Electronics, 13650 Floyd Rd., Ste. 104, Dallas TX 75243; 783-4950** (formerly I.E.).

DEALERS

Your company name and message can contain up to 25 words for as little as $150 yearly (prepaid), or $15 per month (prepaid quarterly). No mention of mail-order business or area code permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the May '85 issue must be in our hands by March 1st. Mail to 73 Magazine, Peterborough NH 03458. ATTN: Nancy Ciampa.

PROPAGATION

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15						20	20A	15			
ARGENTINA	20										15	15
AUSTRALIA	20					40	40			20	20	15
CANAL ZONE	40	40					20	15	15	15	15	20
ENGLAND	40	40	40	80	80		20	15	15	15	20	
HAWAII	20					40	20	20			15	15
INDIA							20	20				
JAPAN	15						20	20				15
MEXICO	40	40	40	40	40	40	20	15	15	15	15	20
PHILIPPINES							20	20				
PUERTO RICO	40	40	40	40	40	40	20	15	15	15	15	20
SOUTH AFRICA	40A	40						15	15	20		
U.S.S.R.		40						15	15	20		
WEST COAST	15	20	40	40	40	40	40A	20A	15	15	15	15

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20				40	40	20	20				20
ARGENTINA	20	40	40	40						15	15	20A
AUSTRALIA	15					40	20	20	20		15	15
CANAL ZONE	20		40	40	40			20	15	15	15	15
ENGLAND	40	40	80	80				15	15	15	20	
HAWAII	20	20			40	40	20	20	20	15	15A	15A
INDIA								20				
JAPAN	20				40	40	20	20				20
MEXICO	20		40	40	40			20	15	15	15	15
PHILIPPINES	20							20	20			
PUERTO RICO	20		40	40	40			20	15	15	15	15
SOUTH AFRICA	20	40	40						15	15	15	20
U.S.S.R.		40	40					15	15	20		

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	15	20			40	40	40				20
ARGENTINA	20	20		40	40						15	15
AUSTRALIA	15	15	20				40		20	20	20	15
CANAL ZONE	20	20		40	40	40	40	40	15	15	15	15
ENGLAND			40	40					20A	20A		
HAWAII	15	20	20			40	40	40				15
INDIA		20	20									
JAPAN	15	15	20				40	40	40			20
MEXICO	20	20		40	40	40	40	40				15
PHILIPPINES	20A	20								20		
PUERTO RICO	20	20		40	40	40	40	40				15
SOUTH AFRICA	20	20							15	15	15	20
U.S.S.R.								20	20	20	20	
EAST COAST	15	20	40	40	40	40	20	20A	15	15	15	15

A = Next higher frequency may also be useful.
B = Difficult circuit this period.

G = Good, F = Fair, P = Poor.

FEBRUARY

SUN	MON	TUE	WED	THU	FRI	SAT
					1 G	2 G
3 G-F	4 F	5 F	6 G	7 G-F	8 F	9 P
10 P-F	11 P	12 F	13 G	14 G	15 F	16 P
17 P	18 G	19 G	20 G	21 G	22 F	23 F-G
24 F-P	25 P	26 P-F	27 G	28 G		

Issue #294

OUR 25th ANNIVERSARY YEAR!

March 1985
$3.00 Canada
$2.50 USA

73 for Radio Amateurs

A CWC/P Publication

International Edition

Special Report: Volunteer Examiners

HAM-DAY '85— Are You Ready?

Ten Million Resistors: The Incredible Digiohm

PRIVATE EARTH STATIONS

On the Cover: The 10½' Continental CX-105 at the Pittock Mansion, Portland, Oregon. Photo courtesy of Continental Satellite Systems, Clackamus, Oregon.

73® for Radio Amateurs

ISSUE #294 MARCH 1985

W. Sanger Green, our "Ancient Aviator" columnist in the 1970s, died Christmas Eve, 1984. We dedicate this TVRO issue to him. Satellites, Shuttle-types, other opportunities high above: I can't say for sure that Sanger ever thought about them when flying, when flying was risky in itself. I suspect he did.—JCB.

4 Never Say Die
7 QRX
10 What?
52 Letters
54 Barter 'N' Buy
55 Be My Guest
57 Special Events
60 Review
63, 71, 91 Ham Help
64 Contests
66 RTTY Loop
67 Fun!
68 Satellites
72 New Products
84 *73* International
94 Dealer Directory
94 Propagation

14 TVRO Trivia
To those would-be satellite enthusiasts wondering which way is "up," W6SMJ offers the comfort of his years of experience in home satellite TV reception. W6SMJ

26 All This and PCII!
Would you like a fully-programmable Morse keyboard that will balance your checkbook and play Sousa marches? Then read on! W4FXI

28 Do Volunteer Examiners Work? A *73* Special Report
National VEC W5YI says yes. He should know. W5YI

34 The Incredible Digiohm
How to put ten million resistors in the palm of your hand? Build the ultimate substitution box. . . . . Rich

38 Speech! Speech!
Here's a talking repeater controller that you can build in no time at all. It gives a whole new meaning to the word "vox"! WA4TEM

44 So Why Do They Call It Wireless?
One easy antenna. Five hot bands. Need we say more? WA8JXE

48 Cheap Heath Help
Is your HW-101's offset off? Try this four-dollar fix. Without it, you're being cheated out of QSOs. K6YB

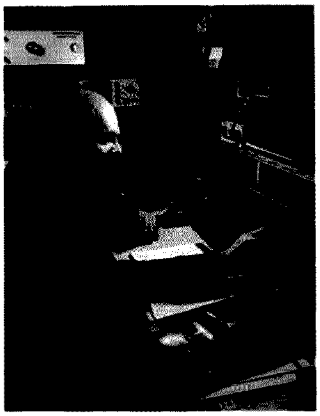
Editorial Offices: Pine Street, Peterborough NH 03458, phone: 603-924-9471. **Advertising Offices:** Elm Street, Peterborough NH 03458, phone: 603-924-7138. **Circulation Offices:** Elm Street, Peterborough NH 03458, phone: 603-924-9471. **Manuscripts:** Contributions in the form of manuscripts with drawings and/or photographs are welcome and will be considered for possible publication. We can assume no responsibility for loss or damage to any material. Please enclose a stamped, self-addressed envelope with each submission. Payment for the use of any unsolicited material will be made upon acceptance. All contributions should be directed to the *73* editorial offices. "How to Write for *73*" guidelines are available upon request. US citizens must include their social security number with submitted manuscripts. **Subscription Information:** Rates: in the United States and Possessions: One Year (12 issues) $24.97; Two Years (24 issues) $38.00; Three Years (36 issues) $53.00. Elsewere: Canada and Mexico—$24.97/1 year only, U.S. funds. Foreign surface mail—$44.97/1 year only, U.S. funds drawn on U.S. bank. Foreign air mail—$79.97. To subscribe, renew or change an address: Write to Subscription Department, PO Box 931, Farmingdale NY 11737. For renewals and changes of address, include the address label from your most recent issue of *73*. For gift subscriptions, include your name and address as well as those of gift recipients. For questions concerning your subscription and to place subscription orders, please call us toll free at 1-800-645-9559 between 9 am and 5 pm or write to *73*, Subscription Department, PO Box 931, Farmingdale NY 11737. *73 for Radio Amateurs* (ISSN 0745-080X) is published monthly by CW Communications/Peterborough, Inc., 80 Pine Street, Peterborough NH 03458. Second class postage paid at Peterborough NH 03458 and at additional mailling offices.

Microfilm Edition—University Microfilm, Ann Arbor MI 48106. Postmaster: Send address changes to *73*, Subscription Services, PO Box 931, Farmingdale NY 11737. Nationally distributed by International Circulation Distributors.

W2NSD/1

NEVER SAY DIE

editorial by Wayne Green



D-DAY

The recent demand by the ARRL Board that the General Manager increase the number of hams this year was indeed entertaining.

The fact is that amateur radio has gotten to be one of the better kept secrets in our country. Recent surveys have shown that those few people who think they've heard of amateur radio are confusing it with CB. It makes an old-time ham proud, right?

Okay, if we're going to get recruits into amateur radio, our first step is to help make the general public aware of what our hobby is—what, if anything, we're doing. There isn't any way we're going to get new hams if people don't even know our hobby exists.

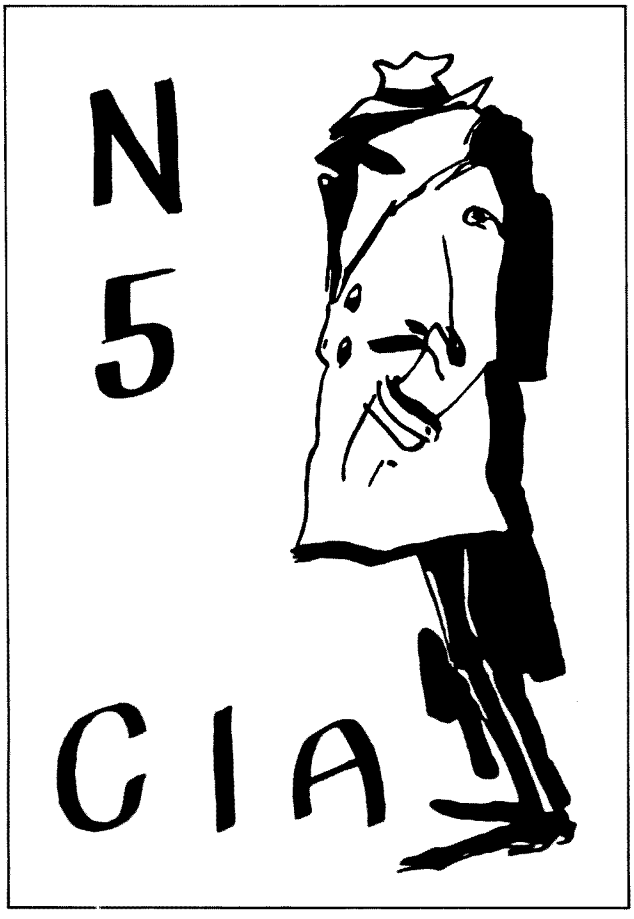
There have been occasional demonstrations of ham stations at fairs and malls, but those I've seen are long on hams sitting there doing incomprehensible things and short on involving the public in even the slightest way. Oh, we may offer to take and deliver a message for passing people, but when the message is delivered weeks later in garbled form, some of the impact of this approach is lost.

Ham exhibits tend to put emphasis on newer technology too—another confusing situation. How many of the general public will have even the faintest idea of what is going on as a ham RTTY printer clunks away, churning out paper or printer artwork? Phooey.

So let's get cracking on something more practical—a real live demonstration of amateur radio. And let's set this up for Sunday, March 24th, so we can all get involved at once. You could pass the word to some DX stations, asking them to be sure to be around on the 24th to help impress visitors to ham shacks all around our country.

Your job is to make sure that you get any friends or neighbors over on the 24th so you can demonstrate amateur radio to them. This may be on a DX band or over a repeater—either way you will have to explain what you are doing (hopefully in plain language) and then let them get on the air and talk with hams and other similar vis-

Continued on page 55



QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, 80 Pine Street, Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

STAFF

EDITOR
Wayne Green W2NSD/1

EXECUTIVE EDITOR
Susan Philbrick
MANAGING EDITOR
Steve Jewett
TECHNICAL/INTERNATIONAL EDITOR
Perry Donham KW1O
EDITORIAL ASSISTANTS
Nancy Cook
Richard Phenix
Chris Schmidt
DESIGNERS
Diane Ritson
Linda Drew
ASSOCIATES
Robert Baker WB2GFE
John Edwards KI2U
Bill Gosney KE7C
Chod Harris VP2ML
Dr. Marc Leavey WA3AJR
Bill Pasternak WA6ITF
Peter Stark K2OAW

ADVERTISING
1-800-441-4403
SALES MANAGER
Jim Gray W1XU
ASSISTANT SALES MANAGER
Nancy Ciampa
SALES REPRESENTATIVE
Ross Kenyon KA1GAV

GRAPHIC SERVICES DIRECTOR
Christine Destrempes
MANUFACTURING MANAGER
Susan Gross
TYPESETTING MANAGER
Dennis Christensen
FILM PREP MANAGER
Robert M. Villeneuve
PHOTOGRAPHY MANAGER
Nathaniel Haynes
GRAPHICS SERVICES SUPERVISOR
Dawn Matthews

VICE PRESIDENT/GENERAL MANAGER
Debra Wetherbee
VICE PRESIDENT/FINANCE
Roger Murphy
ASSISTANT GENERAL MANAGER
Matt Smith KA1IEI
ASSISTANT TO VP/FINANCE
Dominique Smith
DIRECTOR OF CIRCULATION
William P. Howard
ASSISTANT CIRCULATION MANAGER
Frank Smith
DIRECT AND NEWSSTAND SALES MGR.
Raino Wirein
1-800-343-0728
DIRECTOR OF CREDIT SALES AND COLLECTIONS
William M. Boyer

PUBLISHER
John C. Burnett

QRX. . . .

EDITED BY PERRY DONHAM KW1O

Ham-Day '85

MARK MARCH 24th on your calendar. That's H-Day, the day that every amateur in the United States will invite one person into his shack to demonstrate what ham radio is all about. Don't worry about shampooing the carpets or serving a five-course dinner, just ask someone over and make a few contacts. Whip out your hand-held and make a telephone call on the local autopatch. Chat across town or across the world, but be sure that *somebody* is there to watch and take part. ARS W2NSD/1 will be on the air from 1500 to 2100 UTC; look for us around 14.255 MHz or drop us a line and we can make a schedule for a contact. Use any mode and band you feel comfortable with, but please *don't let your hobby down.* Remember: March 24th. Pass it on.

Display Replay

KENWOOD TR-2500 OWNERS: Has your LCD turned a nice shade of black? If it has, Kenwood will mail you a free replacement display. Call the company at (213)-639-9000 and ask for Amateur Parts Supply.

Super Fly!

GOING TO DAYTON this year for the big Hamvention? Fred **Maia W5YI** reports that Piedmont Airlines is offering a 35% discount to hams flying to Dayton on Piedmont. The offer is good for a ten-day period centered on April 27, 1985, and is 35% off the normal coach rate—about as cheap as you can go without needing a parachute. To make a reservation, call (800)-334-8644 and ask Ellie Goforth for the **W5YI Hamvention Special**. Fred says that a lot of the credit for this great deal should go to **Maurice Booth WD4RGU**, who is the Customer Service Manager for Piedmont in Dallas. See you at the show!

GLB Update

PACKETEERS USING GLB TNCs, in particular those using them as digipeaters, should contact GLB for an update of their software. PK-1 software prior to version 3.5 will not digipeat multiple frames with multiple digipeaters; if a PK-1 is specified as part of a multi-repeater link, *only the first frame* in any transmission will be repeated. To get the update, send your PROMs or a $10 deposit to GLB Electronics, 1952 Clinton Street, Buffalo NY 14206. The $10 deposit will be refunded when you return your old PROMs.

Elmer Cited

TEACHING KIDS about ham radio has earned **Peter Kemp KA1KD** an award from the Connecticut Department of Education. Cited by the Commissioner of Education as "...an outstanding vocational practice, one worthy of emulation by other schools," Pete's course is taught during the school day and offers students the opportunity to learn the fundamentals of electronic communication, culminating in (you guessed it!) a Novice-class license. Pete says that he has Elmered hundreds of new Novices through the course, and that the state is evaluating the program for possible inclusion in the curriculum of every school in the state!

Hiss and Pop

FOR THOSE STALWARTS who still monitor the ten-meter band for signs of life, I have a very nice list of ten-meter beacon stations, compiled by **Joe Gumino K2OLG**, that can be yours for the price of an SASE. The list seems to be pretty complete, with about sixty stations spanning the range of 28.175 to 28.992 MHz. If you would like a copy, drop an SASE in the mail to *73 Magazine*, 80 Pine Street, Peterborough NH 03458, Attn: 10m Beacon.

DXtra Special

"QRX" CONGRATULATIONS go out to **Don McDaniel KJ3Q**, the 1984 Outstanding DXer, as determined by the Western Pennsylvania DX Association. Don is an active member of the club and appears regularly on the 145.37-MHz repeater operated by the Association. The repeater is used exclusively for DX spotting and contest announcements, and anyone within its three-state coverage area (PA, OH, and WV) is welcome to join in.

An ecstatic Wayne Albert KB3KV (right) presents the WPDXA Outstanding DXer Award to Don McDaniel KJ3Q.

Peter Kemp KA1KD (right) receives the 1984 VIP Merit Award from Connecticut Commissioner of Education Dr. Gerald Tirozzi.

What's New?

SHAMELESSLY STOLEN from *The Ground Wave*, newsletter of the **St. Paul Radio Club**, are a few items to round out every ham's shack:

•For those who keep blowing fuses, 30-Amp fuses marked "3 Amps."

•Antenna tower holes, in assorted sizes and depths. Why dig when you can buy a hole ready-made? The design has been improved by threading them—if you move, simply unscrew them and take them along!

•Antenna grease. One application is all that is needed—standing waves are lucky if they hang on lying down!

•Everett Dirksen lozenges. A fine product that makes SSB sound like AM. These lozenges provide a golden voice, as compared with the silver voice of the William Jennings Bryan lozenges sold by competitors.

Supplies are limited, so be sure to send your blank check today!

Big Picture

THE V/UHF ADVISORY COMMITTEE of the ARRL is soliciting comments on a proposed 13-cm band plan. The VUAC is trying to formulate a plan that will accommodate all of the current users of the band, as well as allow for future modes and techniques that may be developed. In addition, the VUAC is investigating the exchanges and procedures used in EME and

"Now here's an exclusive new feature . . ."

meteor-scatter communications, with an eye toward a standard system. Everyone's ideas are important, and you can contact the VUAC by writing Mark Wilson AA2Z, ARRL Headquarters, 225 Main St., Newington CT 06111.

Space Aces

NASA SAYS "OK" to the planned ham-in-space flight of **Dr. Tony England W0ORE** and **John-David Bartoe W4NYZ** coming up on April 17th. It sounds as if the astronauts are packing their entire shack for the trip—in addition to the 2-meter rig used by Dr. Owen Garriott W5LFL, Tony and John-David will be carrying HF and SSTV equipment on board. The entire setup will be very flexible, allowing SSTV on ten and two meters, a two-meter to ten-meter repeater (similar to the OSCAR and RS transponders), and of course the 2-meter mode used on the W5LFL mission. The antenna to be used is an unusual design—a form of matching device will be used to excite the entire payload bay. Interestingly, both hams must apply for an FCC waiver for the mission, as only Extra-class licensees are eligible for space operation (both astronauts hold General-class tickets). Watch "QRX" for late-breaking ham-in-space news.

Fuzz Busters!

REMEMBER D&D, Inc., of Shelby, North Carolina? They were raided by Federal Marshals last year and faced fines of up to $10,000 for distributing illegal CB equipment. The raid netted nearly $140,000 worth of gear. Well, the Feds have really outdone themselves with their latest venture! Engineers from the FCC New York District Office and Special Agents from US Customs raided **Granada Electronics** in Brooklyn, seizing over 2700 pieces of gear with an estimated value of *one-half million dollars*! The rigs included CB transceivers capable of operating on unauthorized frequencies and of using excessive transmitter power. The items were manufactured in the Far East and were allegedly imported into the US for illegal sale. In another action, Customs agents arrested **Lawrence Wallach** of LW Sales, Lynbrook, New York, for allegedly selling non-type-accepted CB transceivers which were illegally brought into the US. LW and Granada were the subject of a two-year Commission investigation into the importation and marketing of illegal equipment.

Hands Off

THE NEXT STEP toward an automatic message-delivery system has been made here in New England. **Hank Oredson W0RLI** has added store-and-forward message handling to his popular Xerox 820-based packet bulletin-board software. The system allows a message left on one mailbox to be passed along until it reaches its intended recipient. According to Hank, "The distributed-message store-and-forward system is growing very rapidly. In the Boston area, K1BC, W0RLI, WB2OSZ, and KA1T are all using auto-forwarding. In Arizona, K7PYK is available, linked to W0RLI via HF. Other EASTNET mailboxes now on the air . . . include W3IWI and KS3Q in the Washington DC area, WB2MNF in New Jersey, and W1AW-4 in Newington. At least nine other stations should be coming up in the future. The network, both real-time and store-and-forward, is growing fast." If you are working on a similar system, Hank would like you to get in touch with him at his *Callbook* address. Hank will also provide copies of MailBox—just mail him an 8" disk with return postage.

Voice From Above

LISTENING FOR THE SHUTTLE? The Goddard Amateur Radio Club at the NASA Goddard Space Flight Center in Greenbelt, Maryland, retransmits live audio from the Space Shuttle on nearly all STS missions. **Pat Kilroy WD8LAQ** explains that club station WA3NAN transmits on 3860, 7185, and 14295 kHz, starting about one hour before lift-off and ending about one hour after the Shuttle lands. Off times coincide with the astronauts' sleep periods.

Hello, Mr. Chip

MOTOROLA has finally released a long-awaited member of its M68000 microprocessor family. The original MC68000, found in several micros currently on the market, uses 32-bit internal data representation but has only 16-bit-wide external buses. Motorola's new MC68020 fills the communications gap by providing full 32-bit-wide data streams, both inside and out. Incredibly, the chip can address up to *4 gigabytes* of memory and runs around 3 million instructions per second (MIPs). What's *really* impressive is that all of this power has been condensed onto a die that's roughly 350 mils square! The processor is object-code-compatible with the rest of the 68000 family. What can you do with such a chip? All sorts of ham applications spring to mind. How about voice-recognizing repeaters? Or automatic phone-contesting stations? The price is reasonable—487 bucks—so be sure to buy a few extra for spares!

Oracle

COMING UP IN 73: In April you can take a sneak preview of the Dayton Hamvention, the radio amateur's Mecca. And May brings our annual spring antenna issue, packed with aerials of every shape and size, just in time for that antenna work you've been planning all winter. Of course, every issue is full of the kinds of things you've grown to appreciate in *73*, and we'll be bringing in a few surprises during our 25th anniversary year just to keep you on your toes.

Kudos

SO MANY PEOPLE help make "QRX" happen each month, and it's always a pleasure to thank them. This month, help came from the *W5YI Report*, *Westlink*, *Gateway*, and numerous other hams who support this column with their cards and letters.

Robert J. Buckman W6SMJ
7312 Charnwood Drive
Huber Heights OH 45424

TVRO Trivia

To those would-be satellite enthusiasts wondering which way is "up," W6SMJ offers the comfort of his years of experience in home satellite TV reception.

I have been following the developments in Television-Receive-Only (TVRO) satellite systems since 1975. Five years ago, a few hardy souls were home-brewing systems and developing hardware to make it possible for a hobbyist to afford a TVRO system. Now even your local department store will sell you a system for $3,000—less than a good used car. How low can the price go? How good are the kits? How tricky is installation? How critical are antenna adjustments? How good is the picture? I'll try to answer these questions and describe for you my experiences in building a system.

I see TVRO systems as the shortwave-listening hobby of the eighties. The frequencies involved (4,000 megahertz) and the reception distances (23,000 miles plus) are greater than shortwave conditions, but the basic attractions of the hobbies are quite similar: the desire to log a new country (transponder), the sense of wonder over the reception of a signal from a distant point ("this is NBC London"), and the constant fight over improving hardware (is a 27-MHz i-f bandwidth better than 35 MHz?).

TVRO systems have three basic components: a directional antenna, a low-noise amplifier (LNA), and a receiver. Cables interconnect the three major components and usually some additional electronics is necessary to make sound and picture appear on your TV. Let's look at what's available in those three major categories.

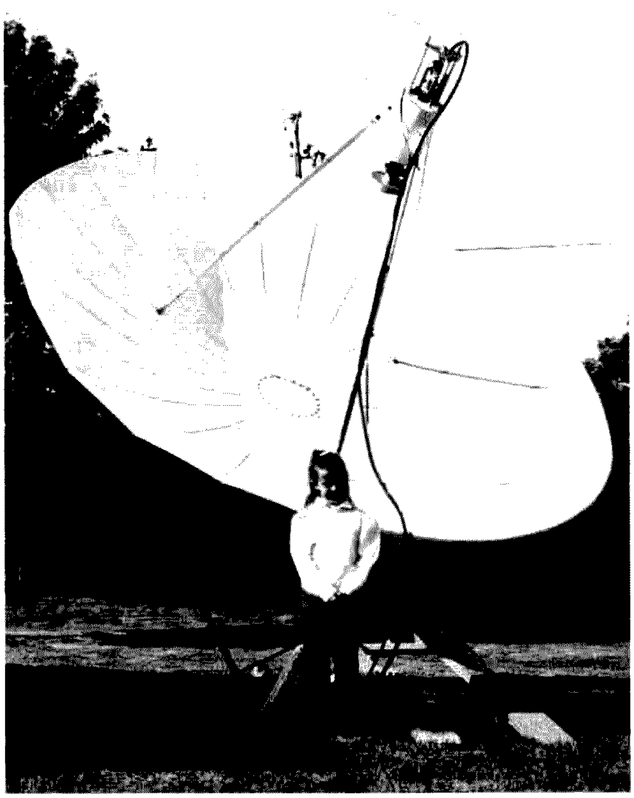


Photo A. The ADM-11 dish—my niece Dawn is about four feet tall.

Antennas

Antennas can be divided into two categories: parabolic and spherical. The advantages of a spherical are that once installed the reflective surface does not have to be moved (the feed is moved to select different satellites), and multiple satellites can be received with multiple feeds. Spherical surfaces are also easier to construct.

Parabolic antennas must be moved to focus on other satellites, are harder to build precisely, and can be used for only one satellite at a time. The parabolic antenna usually takes less real estate to install since the feed is usually contained within the antenna volume, while the spherical feed is usually twenty to thirty feet in front of the spherical surface. I will discuss only the parabolic antenna systems.

There are two general types of mounts for parabolic antennas: the azimuth and elevation (az-el) mount which requires rotation in two axes, and the polar mount which lets you rotate the dish in the plane of the satellites. Several computer programs have been published to allow you to calculate az-el angles based on your latitude and longitude and the satellite longitude (satellite latitude is zero

degrees for geosynchronous satellites). For my installation, a polar mount, az-el angles are uninteresting; the important angle for a polar mount is the polar angle or inclination angle.

A crude estimate of the polar angle is ninety degrees minus your latitude. A better estimate is to take the elevation angle from an az-el chart calculated for your site for the satellite closest to your longitude. (That's the satellite closest to due south of your site.) Expect to rotate the mount up or down a few degrees from that initial polar angle.

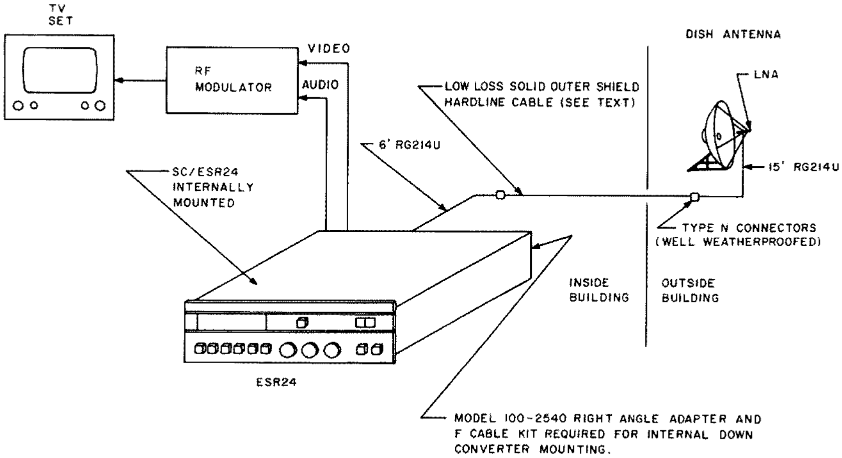


Fig. 1. TVRO system.

Think about your antenna location before committing yourself. Stand on the site and mentally point your antenna south at the initial polar angle while looking for obstructions. All satellites east and west of your location will fall along an arc in the plane of the polar angle. In my case, a neighbor's tree slightly east of my preferred location will grow eventually to block satellites from 75 to 85 degrees west longitude. Since I usually move every three to six years in my profession, I installed the antenna there anyway.

After shopping for years (and even attempting to build—but that's another article), I eventually purchased an ADM-11 parabolic antenna kit with a polar mount at the Dayton Hamvention from an exhibitor who didn't want to disassemble it and haul it home. I got a good price and, when torn down, the dish fit easily into a station wagon (room for two!).

The ADM-11 is an eleven-foot-diameter parabola built from twenty-four pie-shaped segments of 0.090 aluminum bolted together with five-sixteenths-inch hardware and stiffened with aluminum angle braces to support the shape. Assembly of the segments determines the final antenna gain and sidelobe performance.

The main problem with segmented kit parabolas is maintaining the parabolic curve across segment boundaries. No matter how I torque the bolts along the boundary, there is still a gap which will not close completely. How that gap appears to affect performance will be disclosed later.

Of primary importance when installing the polar mount is establishing a true north-south line through the "pole" of the polar mount and a level rotation plane. I'll tell you why that's important later. For my north-south alignment, I sighted the North Star through the polar tube and used a carpenter's level and an auto jack to level the legs of my mount. I had to wedge some plywood under one leg to hold the mount level.

After the dish shape was finished and the steel tripod polar mount assembled in place, I needed three husky folks to help me lift the 200-pound dish onto the "pole" of the polar mount. With the help of three teen-agers from the Explorer post I advise, the dish was placed on the mount in under sixty seconds.

There are at least four variables in parabolic antenna alignment: azimuth and elevation angles, focus depth (the distance from the feedpoint to the center of the dish), and waveguide polarization. Normally, some kind of signal can be received regardless of initial polarization, but you should start with the wide opening of the

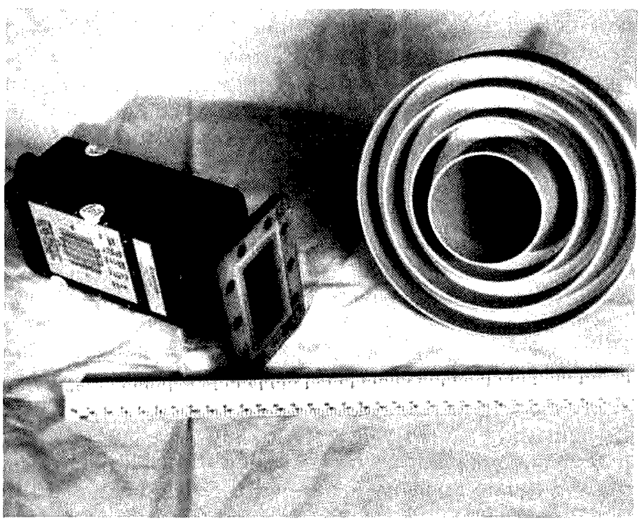


Photo B. An Avantek LNA and the Chaparral feed.

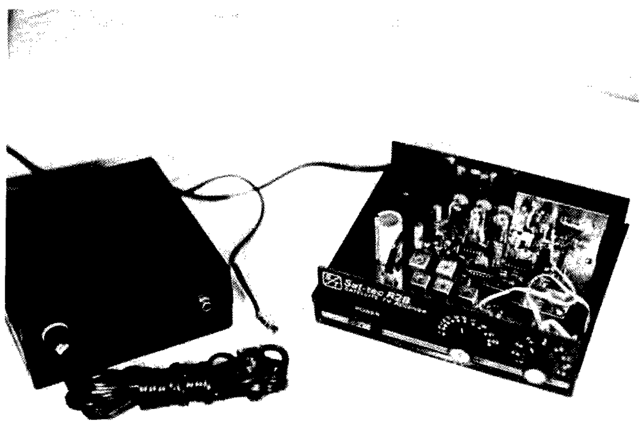


Photo C. The Sat-Tec R2B receiver.

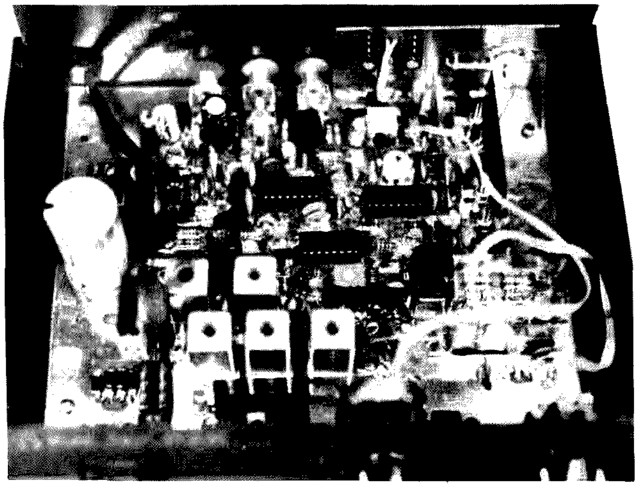


Photo D. All on one board except the first mixer and local oscillator.

waveguide parallel to the horizon. Once a signal is found, rotating the polarization for best signal will eliminate that variable. Even the best dishes will allow a signal of some kind within a half inch or so of the manufacturer's specified focal point. In my dish, focus distance could be moved two to three inches with little effect on the picture or signal strength. This effect is the primary result of the dish segmentation; the focus point is blurred (just like a curved mirror distorts your reflection). The remaining variables then, azimuth and elevation, are the only adjustments left. Before we can adjust those, the rest of the system must be working.

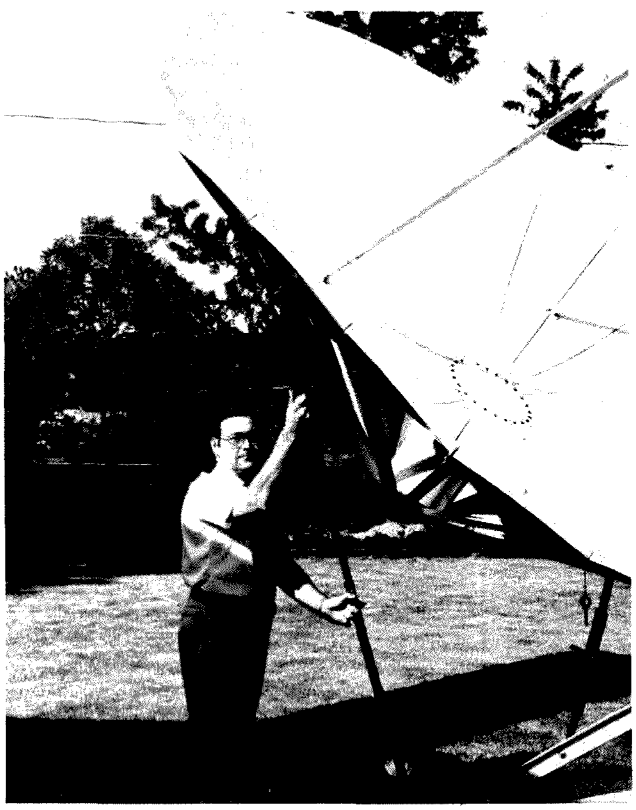


Photo E. To change satellite, just slide the telescoping tube a few inches and tighten the wing nut.

Low-Noise Amplifiers

Next the feedpoint. Whatever reflective surface you choose, the microwave energy is focused to (hopefully) one point, the focus point, where you *must place* the actual antenna. In all the cases I've seen, that antenna is a section of waveguide which is bolted to a matching cavity moulded as part of the LNA. The bolting interface is the WR-229 microwave standard interface.

I suppose you could develop your own antenna cavity, but with the low prices of assembled and tested LNAs today, I chose to buy rather than build. I purchased an Avantek LNA with the 120-degree-Kelvin noise temperature and the nominal fifty-dB gain. Later, I substituted a 100-degree-Kelvin LNA, but observed no significant change in the picture. Unless you are a whiz at 4 GHz or a sucker for punishment, I recommend you buy the three major components from reputable sources—at least until you have an operational system. Then, if you want to experiment with the black art of LNA development, you at least will know where to point the antenna.

There's been a lot of talk about feedhorns: Which is better, how do they work, how critical are the adjustments? A Chaparral feed came with the ADM antenna, but while I was still attempting to build a dish, I purchased an Apollo feed and I did compare the performance. The Apollo is slightly larger than the Chaparral, with an adjustable reflecting ring which slides along the circular waveguide.

I attempted to see what effect the ring has on signal strength and picture quality. If you put your hand over the waveguide opening, the signal goes away; the signal doesn't penetrate flesh. It's important, therefore, to avoid body effects in measuring the differences. I moved the ring from the back of the feed to completely off the feed with no significant change in the picture or signal strength. I did find a small peak in signal strength at one position close to where I had started, and I locked the set screw down there. I'm sure I was affecting the sidelobe performance, but it didn't show in the picture. The Apollo also had more signal strength than the Chaparral on all transponders, but I don't know why. I also tested an old brass horn feed—its performance was lower than either of the other feeds by almost two full units on the Drake's signal-strength meter—no matter where I adjusted the focus depth—with significantly more noise in the picture (I considered that picture unwatchable).

Cable Losses

How do you get the amplified 4-GHz signal to your receiver? If you look at what the booth exhibitors use, you'll find a mixture of hardline, RG-8, RG-214, RG-58, and some unlabelled stuff that looks like it's been through the war. The instructions supplied with most receivers suggest that RG-8, RG-214, and RG-213 have roughly the same losses at 4 GHz and recommend less than eighty-foot runs. I started with a fifty-foot length of RG-213; I had good pictures on some transponders and weak to nonexistent pictures on others. RG-217 has five dB less loss per hundred feet than RG-213, so I ordered fifty feet and then temporarily cut ten feet off the RG-213 to estimate the improvement I could expect (it should be about 1.7 dB). Suddenly I had perfect pictures on transponders which had only noise before!

Then the UPS man delivered the RG-217, and I discovered why so few people use it and vendors don't talk

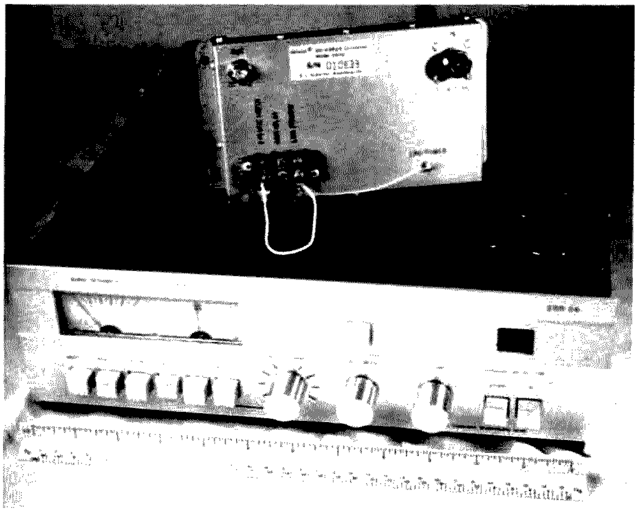


Photo F. The Drake ESR-24 with the downconverter outside the box.

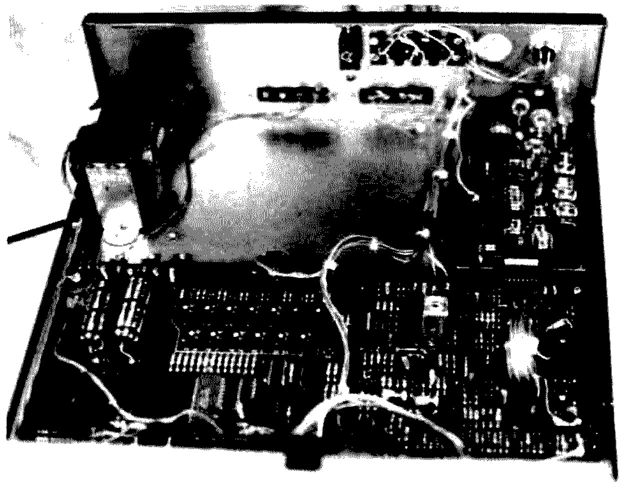


Photo C. The inside of the Drake with space for the downconverter inside.

about the cheap price; the cable is larger diameter than the normal N-type connector; the special-order, oversize N-connectors cost $10.00 each! The stuff is also constructed with a solid center conductor requiring larger-bend radii.

The solution to the 4-GHz cable loss problem is to either use short runs or move the first mixer to the antenna and send lower-frequency signals down to the rest of the receiver. Cable losses are much less at lower frequencies. This approach requires that power and mixer-tuning voltage be run to the antenna. The mixer design must also handle temperature and other environmental extremes. When the mixer and LNA are combined in one package, the device is known as a Low-Noise Converter (or LNC). The disadvantage of this technique is that if the LNA fails, you also have to change the mixer. Since there doesn't seem to be a standard interface for LNC input-tuning voltage, output i-f frequency, or drive capability, the LNCs are not as interchangeable as LNAs are.

Receivers

Let's look inside the house now at receivers. In 1981 I bought a Sat-Tec R2B receiver kit from Ramsey Electronics at the Dayton Hamvention. This receiver has been advertised for several years in full-page color ads. It was showcased in a multi-part article in *Radio-Electronics* in 1982, and the article is a fairly good summary of the assembly instructions. That series of articles is also the only place that a schematic of the first mixer was published. I suppose you could draw a schematic from the assembly instructions which came with the kit, but one was not provided.

The Sat-Tec receiver is a double-conversion, superheterodyne, tuneable, single-transponder receiver with a tuneable audio subcarrier demodulator. Passive diode mixers are used for both i-f conversions, and the Signetics NE564 phase-locked loop (PLL) integrated circuit performs the FM to video and audio conversion in the now-classic style. The second intermediate frequency (i-f) is seventy MHz, and to avoid selecting PLL chips which operate at seventy MHz, an emitter-coupled logic (ECL) flip-flop divides the i-f frequency in half (to 35 MHz) before demodulation. This division requires some tricky biasing of the flip-flop's operating point, but has the bonus of solving the PLL overloading problem; the PLL is now driven by a flip-flop whose output never rises above logic high. Automatic frequency control (afc) is provided to the first i-f oscillator, a Watkins-Johnson monolithic microwave oscillator in a TO-6 case.

The receiver kit is laid out

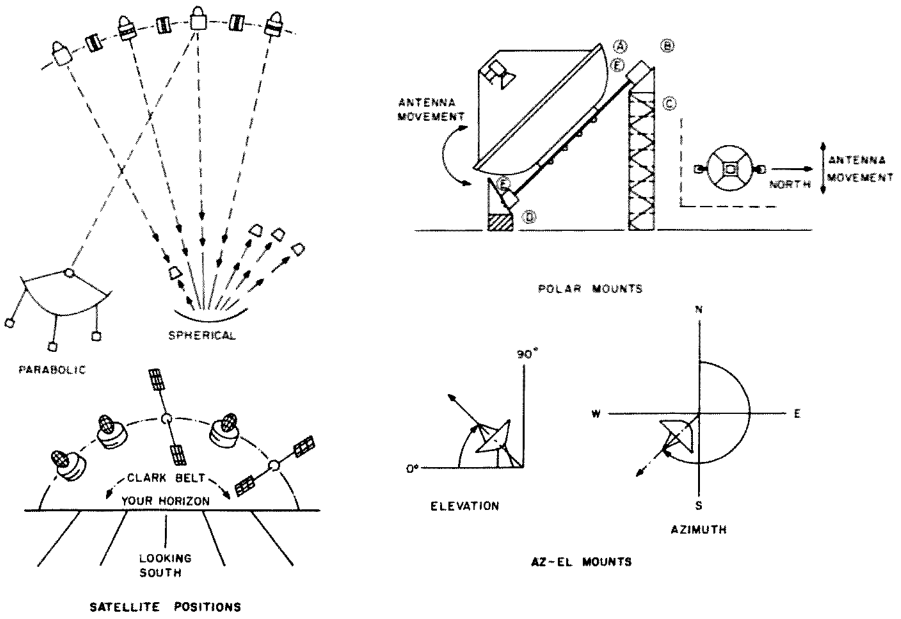


Fig. 2. Parabolic and spherical antennas, polar and az-el mounts.

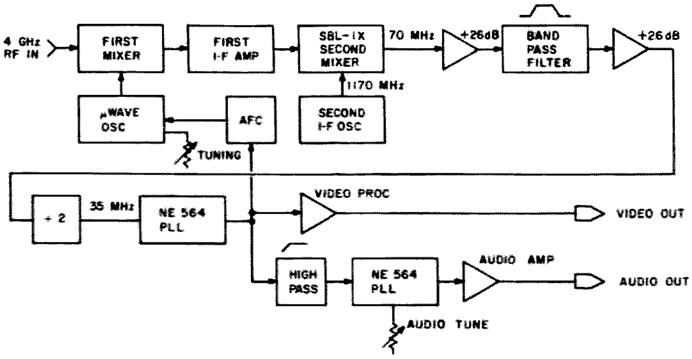


Fig. 3. Sat-Tec receiver block diagram.

on a double-sided circuit board with the second i-f oscillator and second i-f bandpass filter pre-assembled and pre-aligned. The first mixer is constructed as a diode bridge on a separate double-sided circuit board soldered on one edge to the mother board during assembly. The kit instructions are not Heathkit® quality but are sufficient for experienced kit builders. The warning that several capacitors *must* be soldered on both sides of the mother board cannot be stressed too strongly. This board does *not* have plated-through holes; soldering on both sides where indicated is the *only* way to carry ground to several integrated circuits and other parts on the board.

If you're ever in doubt about making a solder joint to a disc capacitor on the component side, take long-nosed pliers and crush the dipped insulation from the ground-lead side *before* inserting the capacitor into the board. Don't be afraid to verify the ground connection with an ohmmeter after soldering.

The pins on the second mixer were much too large to fit the holes provided; I drilled them out with a #55 drill. The rest of the assembly went smoothly, but you have to remember to solder the tin shields in place along all the edges and both sides of the first mixer board to avoid i-f leakage.

The kit receiver-alignment instructions assume a properly aligned and pointed antenna and an operating LNA. Since I had a kit antenna and only the vendor's assurance that the LNA was operating, I had many more potential problems.

In fact, I did have to impose upon another satellite system owner to align my receiver since I did not realize that the noise I saw on my TV set was, in fact, a satellite as I swept the antenna back and forth.

I talked earlier about antenna alignment and selecting the polar angle and then looking for a satellite. The antenna manufacturer recommends using SATCOM 3 for testing since that bird has 24 transponders, most of which have signals all the time. I have to agree that for a receiver like the Sat-Tec (without a scanning capability), it's better to find a satellite with lots of signals so your probability of finding one is higher.

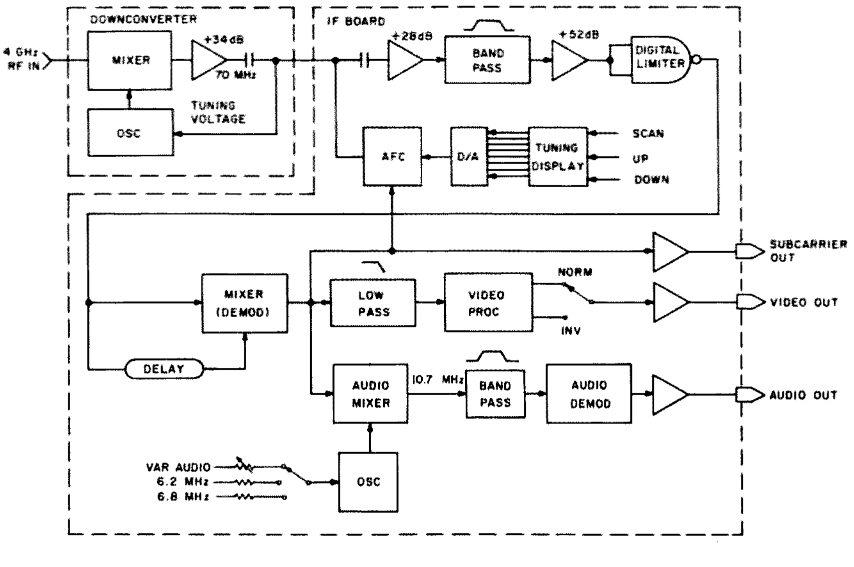


Fig. 4. R. L. Drake ESR-24 receiver block diagram.

The process I use for finding satellites involves lots of antenna movement. First, pick a polar angle. Then, sweep the sky slowly looking for *any* signal, even if it looks like noise. If you find something, lock the antenna down and tune the receiver looking for any kind of picture. Rotate polarization, too. The signal you see may not be television but instead a data transmission or a telephone multiplex carrier. If you see nothing in the sweep of the dish, adjust the elevation (or polar angle) and try again.

Once you have found something, the first i-f stages must be aligned. The tuning on the first i-f is sharp; plus or minus half a turn of the piston capacitors makes all the difference in the world. If you didn't start with the pistons five turns out, you may never see a picture.

Tuning of the PLL is sharp too, and it interacts with the front-panel tuning control and the flip-flop bias adjustment. In my receiver, the audio tuning is also sharp and, when tuned below the 6.2-MHz subcarrier frequency, degrades the picture as well (no, I don't know why).

In the design of the receiver, pains were taken to attempt a linear front-panel control for transponder selection. But the nominal dc voltage to the tuning circuit is +18 volts; my power supply generates about +20 volts dc. When the tuning pot is minimum, set to transponder one, and the dial-set trimmer control is set to transponder one, not enough dial range is available to tune all twenty-four transponders.

The kit instructions say that a dc isolation block (a device to couple power into the coax to supply the LNA) is not required and that a four-inch piece of enameled wire can be connected from the LNA power phono jack to the center pin of the 4-GHz rf input connector. A high enough impedance will

exist to avoid signal loss. I tested this trick with an external Avantek dc isolation block. It's true: The external block was not needed, but in my receiver the lead dress on the four-inch wire did make a difference in the picture, and by looping one turn of the wire around C71, a ten-microfarad electrolytic capacitor on the first mixer board, the black and white shot noise known as the sparklies went away.

I noticed a similar effect with the tuning control wires, which run from the rear of the circuit board to the front panel. I also found spots along the i-f shields where placing my fingers would reduce the sparklies. That noise was my first clue that I had a receiver problem. When I placed an alligator clip on the edge of the mixer board and all the sparklies went away, I was sure I had a receiver problem.

As time went on, a warm-up period became necessary to get any picture. Finally the receiver died and, during troubleshooting, I discovered that the microwave first i-f oscillator had failed. During the disassembly, I found that no connection was made from the shield side of L10 to the mixer diodes junction. During assembly, I neglected to verify this connection with an ohmmeter because it would have involved applying the ohmmeter current source back into the microwave oscillator, a $100 part. The open shield provided no signal return for the microwave oscillator, and probably caused its failure. I'm impressed it lasted as long as it did.

Since that failure and some half-hearted troubleshooting attempts, I purchased a Drake ESR-24 receiver. The Drake has all the features I could ask for: push-button up or down transponder tuning with digital display, center-tuning and signal-strength meters, a scan mode for rough antenna alignment, fixed and variable audio subcarrier tuning, and even a front-panel audio-volume control. The downconverter is a separate box which can be remotely mounted near the LNA to cut 4-GHz cable losses—recent distributor price cuts have made it affordable. The clean-cut front-panel layout makes the receiver look like a quality piece of stereo equipment. Delivery from Hoosier Electronics took four days (two were the weekend) and it worked when I turned it on.

Photo H. The video rack with Drake receiver, Pioneer video tuner, and two Beta video cassette recorders.

Of course I couldn't wait to get the cover off and compare designs with the Sat-Tec. The instruction manual doesn't provide a schematic or even a block diagram, but for $15.00 Drake will sell you a schematic set which includes all the schematics and a more detailed set of alignment instructions.

The Drake receiver is a single-conversion, superheterodyne, tuneable, single-transponder receiver with one pre-selected or tuneable audio subcarrier demodulator. The first mixer, i-f oscillator, and two stages of 70-MHz i-f amplification are mounted in a separate metal box which may be mounted closer to the LNA or inside the receiver case. Negative dc tuning voltage from the receiver is fed back up the i-f coax cable to the first mixer. A separate pair of wires supplies 15 volts dc to power the mixer and LNA.

Inside the main receiver case are two double-sided printed circuit boards; one is the i-f amplifier/filter board and the other board holds everything else but the power transformer and the meters.

The i-f circuit board has two more 14-dB i-f gain stages before the bandpass filter and three more gain stages (all Motorola MWA 120s) after the filter. Signal strength is sampled at the output of the first i-f stage after the bandpass filter. It's first isolated with a transistor and then converted to a dc level by a voltage-doubler diode pair for application to the signal-strength meter.

An i-f gain control is provided between i-f stages one and two, before the bandpass filter, to reduce the signal level if required. In my installation, most domestic transponders will pin the signal-strength meter with that control all the way up.

One last component on the i-f board is a digital integrated circuit, a Schottky quad dual-input NAND gate used as a limiter at the output of the i-f chain. Since the information on the 70-MHz i-f is frequency and not amplitude, the signal is applied to the input of the NAND gate where the alternating-current i-f voltage will change the output of the NAND gate from logic high to logic low as the zero-to-one input threshold is crossed, effectively amplifying the i-f signal yet clipping the signal between logic high and low to eliminate any amplitude components.

The main receiver board contains CMOS digital ICs for transponder selection and digital display. The detector is a simple doubly-balanced mixer which is self-excited by delaying the input signal through a coax delay line. The base band output is low-pass filtered for video processing and for i-f oscillator afc. The base band is also mixed with a voltage-controlled oscillator (vco) to produce a 10.7-MHz sound i-f which is applied through a ceramic filter to a CA-3089 FM i-f amplifier/detector integrated circuit to recover one channel of audio.

Troubleshooting

After installation and about four weeks service, the displayed signal strength became intermittent with a corresponding drop in picture quality. Since the signal was intermittent and seemed to be affected by the fine-tuning control, I assumed I had a receiver problem. I took the receiver to the

Drake factory a few miles south and asked for warranty service. While I watched and waited, the Drake service personnel put the receiver on the bench and fired it up. When, after fifteen minutes, the signal strength never dropped below a four, I conceded the problem was not the receiver. I borrowed an LNA from another TVRO owner and sure enough, signal strength again pinned the meter.

Avantek charges $50.00 per hour to repair out-of-warranty LNAs. If the first transistor is zapped, the parts cost starts at $125. With the recent drop in LNA prices, Avantek will call you when the repair estimate gets close to the price of a new LNA. I sent the LNA back to California by UPS, and three weeks later it was returned with new warranty seals and a calibration chart showing a 100-degree noise figure at the center of the band.

After that repair I had several more weeks of excellent service—I hadn't missed a football game I wanted to see. But one night after a rain—no picture, no snow, no hiss, nothing. No signal strength or snow implied a bad receiver. I couldn't borrow an LNA this time to check, but most receivers have some snow even with the LNA disconnected. I went back to the factory again, but the efficient service folks again found nothing wrong. Could the LNA have died so soon after repair? I ordered another LNA by telephone (I wanted a spare anyway) and two days later it arrived. After installation there was still no picture, but I had found that the i-f gain control was set too low to show snow before I installed the new LNA. What's left? Coax? Connectors? I took out the L-shaped, N-type adaptor I had originally installed at the rear of the LNA and found a film of water inside the connector. After blowing it dry and reconnecting the LNA, I had perfect pictures again! Moral: Keep your connectors dry!

Before I had fastened the dish to the ground, a gust of southerly wind had tipped it over. It landed on one side and flattened the edge of three of the segments. I thought I was in big trouble. All the articles I had read said that the parabolic surface must be precise, with any deviation causing almost total lack of signal because of destructive interference within the antenna. So when I stood the dish up again and pointed it in the right direction, I was expecting the noisy, barely-discernible signal I found. But, at the angle the dish fell, one of the feed support legs could have been bent moving the feed from the center of the focus. So I went through the dish alignment steps again and found I was locked on a new sidelobe, a distortion in the antenna pattern. The main lobe, once I found it, was almost as good as before the fall.

Recommendations

Don't attempt to build from scratch unless you have lots of time, test equipment for all the frequencies required, or exceptional skill.

If you buy a kit for any of the three major subsections, don't buy another kit for another subsection unless you fall in one or more of the categories above. Someone with two different subsystem kits and no microwave test equipment will have to be very lucky to get a station up in reasonable time.

If you must experiment, get a system working *first*, then substitute at the major component level (like receiver, antenna, etc.).

Don't try to get by cheaply—Mother Nature is not kind at 4 GHz, and 22,000 miles is a lot of path loss. ■

Bob Lockwood W4FXI
3 Eighth Street
Radford VA 24141

All This and PCII!

Would you like a fully-programmable Morse keyboard that will balance your checkbook and play Sousa marches? Then read on!

The idea of using the Radio Shack/Sharp pocket computer as a memory keyer has been a goal of mine since Wayne Green, publisher of *73*, first suggested it in an editorial several years ago. The original pocket computer proved to be much too slow and lacked a complex Basic interpreter. Recently, however, I heard the new PCII playing *The Stars and Stripes Forever* at the local Radio Shack and reasoned that the sound function, a programmably-controlled "beeper," could be employed to turn the PCII into the first truly portable memory keyboard.

At the going price of $199, I could afford only the computer. Consequently, the memory keyer that evolved does not use a printer or additional memory. As an added bonus, no modifications are made to the computer, and the interface can be built in less than an hour.

The Program

As a CW enthusiast, I wanted a keyer with both fixed and variable memories and an active keyboard for long rag-chewing sessions. The program, adapted from concepts of Allan Joffe,* meets those requirements and is a delight to operate. (See Fig. 1.)

The program uses an INKEY$ routine to keep the keyboard active, employs the ")" key as an input for a variable memory, and has four fixed memories accessible as keys "*", "+", "=", and "−". When a key is depressed, the character produced is translated into a number in which a dot is a 1 and a dash is a 2. Consequently, A becomes 1–2 and B becomes 2–1–1–1. The MID$ routine peels off the numbers one at a time and sends the results to the GOSUB routine, where a timed beep is produced.

```
  2 C=O:J=O:GOTO 12
  4 J=LEN (B$)
  6 C=C+1
  8 GOTO 14
 12 A$=INKEY$: IF A$=" " THEN 12
 14 IF A$="A" THEN LET A$="12": GOTO 100
 16 IF A$="B" THEN LET A$="2111": GOTO 100
    (THE REST OF THE LETTERS AND NUMBERS ARE
    ENTERED IN THE SAME WAY.)
 86 IF A$=")" THEN 120
 88 IF A$="/" THEN 124
 90 IF A$="*" THEN 126
 92 IF A$="+" THEN 128
 94 IF A$="-" THEN 130
 96 IF A$="=" THEN 132
 98 GOTO 12
100 L=LEN(A$)
102 FOR X=1 TO L
104 C$=MID$(A$,X,1)
106 IF C$="1" THEN GOSUB 134
108 IF C$="2" THEN GOSUB 136
112 NEXT X
114 IF C=J THEN 2
116 C<J THEN 6
118 GOTO 12
120 F$=" ": INPUT F$
122 GOTO 12
124 B$=" ":B$=F$: GOTO 4
126 B$=" ":B$="DE W4FXI": GOTO 4
128 B$=" ":B$="UR RST IS": GOTO 4
130 B$=" ":B$="QTH RADFORD VA": GOTO 4
132 B$=" ":B$="NAME BOB": GOTO 4
134 BEEP 1,8,100: RETURN
136 BEEP 1,8,300: RETURN
138 END
```

Fig. 1. Morse program for PCII.

Using the Keyer

Carefully type in the program. Be sure to change lines 126, 130, and 132 to your call, QTH, and name. Put the PCII in the run mode, type and enter "run." The keyboard is now "active," and depressing any letter or number key will send the code through the beeper. I would recommend that you practice using the keyboard to develop a feel for the timing before you actually put it on the air. By modifying the length of the beeps, lines 134 and 136, one can send properly-timed code up to about 25 words per minute.

The effective use of the variable and fixed memories

*Joffe, Allan S., "Morse Resource—Part 1," *80 Microcomputing*, August, 1981.

adds immeasurably to real CW enjoyment. Imagine you are listening on 15 meters and hear BY1PK. You immediately depress ")" to access your variable memory and type in and enter his call. When he signs, you hit "/" to send what was in the variable memory—his call. Want to send it again? Simply hit "/" again. Now depress and hold the "*" and your call will hit the airways. Use the active keyboard to enter the proper closing.

Let's assume BY1PK hears you and responds. You're ready! Depress "/" to send his call, and then depress and hold the "*" for yours. Continue the QSO by depressing and holding "–", "+", and "=" in turn. Remember your keyboard is active, so you can add the RST and other comments at the appropriate times.

If you are like me and BY1PK did not respond, you can always load a CQ into the variable memory and then change the CQ to the call of whomever responds.

The Interface

The PCII comes equipped with a 60-pin expansion port. However, Radio Shack does not tell you what the 60 pins are for. I asked myself a simple question, "Would the folks at Radio Shack/Sharp design a pocket computer that enables the programmer to control the number, frequency, and duration of a beep and not access that information to the outside world?" Of course not!

Pick up the PCII, hold it horizontally, and look directly at the expansion port. Use just the top row and count from left to right to pin four. Pin four outputs the beep. Now examine the bottom row of pins. Count from right to left to pin 13. That's your ground.

The beeps are routed from the computer to the interface on a shielded cable. Choose a cable size that will enable you to insert 1/8 inch of the center conductor directly into pin four and braid into pin 13. On the other end of the cable, attach a miniature plug. Once you have inserted the cable into the computer, the beep goes off and the audio signal is routed on the cable to the interface where it will be amplified and converted into dc to key your rig. Sounds complicated, but it's not. The amplifier is pre-assembled for you by Radio Shack. They call it a Mini-Amplifier, and it sells for $11.95. Attach the cable you just prepared to the input of the Mini-Amplifier. Remember to put in a 9-volt battery.

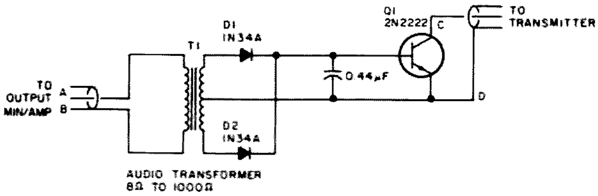


Fig. 2. The rectifier circuit.

The rectifier circuit (see Fig. 2) can be built on a piece of 1- by 3-inch perfboard. Attach the Mini-Amplifier output to points A and B. Attach another piece of shielded cable from points C and D to the keyer jack of your rig. Turn on the amplifier/rectifier circuit, your PCII, and rig. Enjoy great CW! After you see how well it works, I would suggest putting the entire interface in a metal case and routing the on/off volume control and jacks to the exterior of the case. ■

Frederick O. Maia W5YI
1020 Byron Lane
Arlington TX 76012

Do Volunteer Examiners Work? A 73 Special Report

National VEC W5YI says yes. He should know.

There is much confusion and misinformation about volunteer amateur-radio examinations. The US government is now completely out of the ham testing business. The following is the history of volunteer examinations and how one amateur seeks to make Amateur Radio Service testing readily available nationwide. Texas amateur Fred Maia W5YI is a longtime ham, a QCWA member, and a member of Mensa, the high-IQ group. He publishes the internationally acclaimed W5YI Report, *a twice-a-month ham-radio newsletter. He was the first to be appointed a VEC in all regions. The only other national VEC is the ARRL. Here is his story complete with everything you ever wondered about the FCC's volunteer program.*

Turning ham-radio testing over to the amateur community really didn't come as a surprise to us. I predicted it nearly four years before it happened. The handwriting was on the wall when the FCC started abolishing its commercial radiotelephone license program. The Third Class Permit was the first to go. As far back as 1980, FCC Chairman Charles Ferris was on record as supporting broadcast industry testing procedures rather than those of the FCC. He said that government administered tests "do not account for experience and common sense . . . and were susceptible to 'cramming at the last minute.'" He said that "the government may be able to remove itself from the testing process without any adverse impact."

Ferris' statement also came at a time when Dick Bash KL7IHP's *Final Exam* was at its pinnacle. His book listed the verbatim FCC questions and answers to amateur-radio exams. It sold by the thousands. Bash got much of his material from amateurs, who after taking FCC tests, returned the "feedback" cards that he inserted in his book. In all fairness to Bash, his book wasn't that much different from the League's previously published red-and-black *License Manual*. It was just more accurate.

Every year, it seems, the FCC runs out of money and issues its now classic "interim guidelines statement" declaring that routine services will stop until Congress acts on appropriations. Fiscal 1981 (which started in October, 1980) was no exception. With serious FCC budgetary problems and personnel cutbacks, amateur-radio testing was beginning to look like an expensive and unnecessary exercise in futility to them.

Putting two and two together, I wrote a front-page article in my September 1, 1980, *W5YI Report* about the FCC getting out of the testing business. It was an obvious and logical conclusion to me. Few amateurs put stock in my observations.

Volunteer Testing Becomes a Reality

Senator Barry Goldwater K7UGA, politically the nation's highest-ranking amateur-radio operator, played the major role in what was to become Public Law 97-259. Legislation covering volunteer examinations actually had its start, however, in the spring of 1981, when William E. Dannemeyer (R–California) proposed a Communications Act Amendment that would allow volunteers to legally administer the Novice examination. Even though Novice exams had been administered by volunteers for decades, Dannemeyer said: "Government rules forbid volunteer help by a private citizen." Dannemeyer added that: "This practice saves the FCC money . . . and is more convenient for the amateur community by eliminating the need to travel to an FCC field office, which is often a good distance away." He felt that the law should provide for volunteer amateur-radio operator testing.

Goldwater picked up on this theme and proposed as a saving to taxpayers that *all* amateur-radio operator examinations be prepared, administered, and graded by ham volunteers. Congress approved volunteer testing as part of the "Communications Technical Amendments Act of 1982." It was signed into law by President Reagan on September 13, 1982. On October 22, 1982, the ARRL filed a petition seeking to implement the volunteer testing portion of Public Law 97-259.

The following year, a Report and Order was adopted by the FCC authorizing volunteer ham testing. A system of regional VECs (Volunteer Examiner Coordinators) was established to act as a liaison beween the FCC's licensing facility and each team of three volunteer examiners who would administer the tests. The American Radio Relay League had wanted a single national non-profit organization to be appointed as amateur-radio operator test administrator. Instead, the FCC embarked on the regional VEC concept "to generate sufficient interest in the VEC function and to get a significant amount of participation in the program."

League Balks at Becoming a VEC

Everyone thought that

once volunteer testing was approved, the ARRL would immediately apply to become a VEC in all regions. Such was not the case. The League said that they wouldn't apply to become a VEC unless out-of-pocket expense reimbursement was authorized. At the League's urging, on November 3, 1983, Goldwater authored a bill (S.1045) to permit volunteers to be reimbursed by applicants up to $4.00 for ham examinations above the Novice level. A provision was made for increases in the expense reimbursement based on inflation.

Meanwhile, the FCC said that 1984 would be the last year that they would administer amateur-radio operator examinations, and even then only on a quarterly basis. Amateurs began to feel uneasy because it was beginning to appear that future amateur testing would be very scarce . . . and possibly nonexistent. On December 8, 1983, President Reagan signed FCC budgetary legislation which had ham-test-expense reimbursement tagged to it. It still had to be implemented by the FCC.

By the spring of 1984, about a half dozen VECs had been approved by the Commission and they began to accredit volunteer examiners and give ham tests. There were many complaints among VECs about lack of cooperation from the League. It got the volunteer examination program off to a rocky start. The ARRL still had not applied to become a VEC, stating that they were waiting for the Commission to establish amateur-radio-operator exam reimbursement.

The FCC issued a Notice of Proposed Rulemaking on March 9, 1984, asking the amateur community how expense reimbursement should be handled. The last year of FCC testing was half over when we filed our proposal with the Commission to become a VEC in all regions. Even though expense reimbursement had not been approved, we agreed to become a VEC based on a unique concept. Instead of amateur-radio-operator testing materials being provided by the VEC, our VEs would be allowed to purchase them in the independent publishing marketplace.

Even though the League said a volunteer testing program without expense recoupment would bankrupt them, it didn't appear to us that being a national VEC would be that expensive a proposition, particularly if the needed materials were commercially available. On June 12, 1984, the FCC approved our proposal and appointed us a VEC in all regions—the first VEC to be so authorized. The Commission issued us instructions shortly thereafter. Our program accredits only Extra-class amateurs as volunteer examiners, since only they can administer all written exams and *any* of the code tests.

It also appeared to us that amateur radio was entering the doldrums again. Ham radio showed great growth in the 50s. Amateur radio didn't move forward again until the mid-1970s, when the FCC discontinued charging fees for its ham tests. There has been basically no growth in the number of amateur-radio operators during the past two years.

If a volunteer licensing program was to work, we reasoned that it would require the following elements:

- Simple and streamlined procedures
- Wide availability
- A minimum of waiting to administer the tests
- Easy administration
- An inexpensive cost
- Well-publicized availability

We kept these points in mind when making decisions regarding our program.

Volunteer Examiner Coordinator

The VEC does not give tests. A VEC merely coordinates the testing and licensing function and acts as the link between the government and the volunteer examining team. A VEC also:

1) Recruits and accredits volunteer examiners and issues accreditation documents.

2) Keeps volunteer examiners aware of additions and amendments to program rules.

3) Provides for or approves amateur testing materials.

4) Provides for necessary test-session forms such as FCC Form 610, application forms, test reports, Certificates of Successful Completion, etc.

5) Collects successful candidates' application forms, answer sheets, and test results.

6) Prepares and maintains records of testing sessions.

7) Screens and forwards successful applications for amateur-radio operator licenses to the FCC in Gettysburg PA.

8) Resolves defects in FCC Form 610 made by applicants.

9) Evaluates test questions to ensure clarity and accuracy and forwards recommendations to the FCC.

10) Determines amount of out-of-pocket reimbursable expenses and ensures that annual expense certification documents are forwarded to the FCC.

The Volunteer Examiner

The FCC requires that three volunteers administer amateur-radio operator examinations above the Novice level. The volunteer testing program rules require that the written exams be administered by amateurs holding higher class licenses than those tested. Only Extra-class volunteer examiners can administer the 13- and 20-wpm code tests. In view of this, we only accredit Extra-class amateurs in our program.

To be a VE under our program, you simply must send us the following *signed* statement along with a photocopy of your current FCC amateur Extra-class license: *"I am a currently licensed Extra-class amateur-radio operator and wish to be a volunteer examiner. I have never had my station or operator license revoked or suspended. I do not own a significant interest in nor am an employee of any company or entity engaged in making, preparing, or distributing amateur-radio equipment or license-preparation materials. My age is at least 18 years old."* There are no

Fig. 1. Volunteer examiner certificate.

other requirements and the accreditation is for an indefinite period of time. (Send to: W5YI-VEC, PO Box 10101, Dallas TX 75207.) We also have a volunteer examiner certificate (see Fig. 1) available for $1.00, but it is not necessary that a VE have this.

Since it takes a three-man accredited VE team to give ham tests, it is important that you recruit at least two additional (and preferably more) Extra-class amateurs in your area to assist with test administration. No examinations can be given without three fully accredited VEs. Both large-scale and small test sessions (as few as a single applicant) can be conducted.

So You Want To Give A Test

Until recently, a VEC had to notify the FCC 30 days in advance of an amateur-radio operator testing session. This required that we be notified a minimum of six weeks in advance. We wrote the FCC last November asking for a modification of this rule. The purpose of this notification was to provide local FCC field offices with testing information so that they can properly respond to amateur-radio operator test inquiries. We felt that the letter writing was burdensome, required excessive advance planning on the part of the VE, and we noted that some testing sessions (such as those involving ham-radio graduating classes or handicapped individuals) are not open to the public.

Effective January, 1985, the FCC notification requirements have been eliminated. This has greatly speeded up test administration. VEs now only have to advise the VEC that a test session will be held and request appropriate testing information. This can even be done by telephone! The test session can then be held immediately. All we require now in the way of advance information is the city and state that the test will take place in, the date of examination, and the name, callsign, address, and telephone number of the volunteer examiner.

The VEs must make a public announcement before each examination session. The announcement must show the amount of reimbursement fee required from each candidate and where and how it is to be paid. This public announcement can be in any form, including an announcement at a club meeting, club bulletin release, posted handbill at the local ham equipment supplier, or an announcement on your local amateur repeater.

Testing Materials

The enabling legislation not only authorized volunteer ham-test administration, but *preparation* by amateurs as well. During 1982 and 1983, the FCC mounted a campaign to develop banks of questions which would form the various amateur-radio examination pools. It was decided that ten times the number of questions as needed in any one test would be generated.

The amateur community was invited to submit questions for use in the examinations—one question to a sheet of paper complete with the proper answer and reference source confirming the correct answer. The ARRL and Dayton Amateur Radio Association contributed the most questions and it took over a year to come up with all of the needed questions. Many left a lot to be desired.

The FCC released the questions to the public in various PR bulletins. Many amateurs not familiar with the volunteer examining program were shocked to learn that the actual questions were now publicly available from the Commission. Only the questions and not the answers were released. Many questions had more than one right answer. We filed a Freedom of Information Act request with the FCC for the answers. This was approved and I sent the FCC's contract copying service to the Personal Radio Branch in Washington DC to get them. We later forwarded the answers to all known amateur-radio operator license-preparation material publishers.

The ARRL went on record as stating that, in their opinion, not only the questions, but the multiple-choice answer and distractors (wrong answers) should be part of the question pool as well. The FCC said that any amateur that memorizes all questions in the pool would have to have knowledge of the subject since the number of questions was so vast (see Fig. 2).

The Advanced questions were due for revision in February and may have been already revised by the time you read this. Our understanding is that very few questions will be changed, however. The FCC revises the question pools once a year on a staggered quarterly basis. Volunteer examiners submit their recommendations for question changes, deletions, and additions, according to the schedule in Fig. 2, to their VECs, who in turn forward them to the FCC.

On June 27, 1984, the ARRL applied for VEC status in all regions to take effect upon implementation of expense reimbursement. It was the first instance that a license-preparation material publisher had applied to coordinate tests. As a prerequisite to the ARRL becoming a VEC in all regions, the League was required to release their multiple-choice questions to the public and place them in the public domain so as not to gain a publishing advantage. The League sent their multiple-choice questions and answers to all other VECs and known license-preparation publishers. They were advised that they could republish them if they wished. At least two of them did (West Radio School and AMECO) and more are sure to. The ARRL was approved as a national VEC on July 21st.

License-Preparation Materials

Widespread availability of adequate testing and license-preparation materials must occur if volunteer testing in the Amateur Radio Service is to succeed. We have approved the tests of the West Radio School (Gordon West WB6NOA, 2414 College Drive, Costa Mesa CA 92626; (714)-549-5000) for use by our VEs. Gordon has ten different versions of every written and code test. We merely advise VEs which versions should be administered. In the interest of making volunteer amateur testing more readily available, Gordon has reduced the price of his testing series to only $10.00 for *all* of his testing materials.

The West Radio School *VE Test Set* contains ten dif-

License Class	Written Element	Question Pool	FCC Bulletin	Current Version	Questions Reviewed
Novice	Element 2	200 questions	PR-1035A	August, 1984	July 1
Technician/ General	Element 3	500 questions	PR-1035B	November, 1984	October 1
Advanced	Element 4A	500 questions	PR-1035C	April, 1984	January 1
Extra	Element 4B	400 questions	PR-1035D	April, 1984	April 1

Fig. 2. The FCC question pool.

ferent versions of the Element 3, Element 4A, and Element 4B written examinations and ten versions each of the 5-wpm, 13-wpm, and 20-wpm code tests on three cassette tapes. You can photocopy as many blank test sheets as you need once we tell you which one to administer. The code tests are excellent. You don't have to say a thing. All of the testing instructions—even a practice copying session—is right on the tape. The test set includes all of the answer sheets for the VE team. The $10.00 price is actually under his cost, but he wants this as his contribution to the volunteer testing program.

Once the test questions and answers are known, the pass rate should dramatically increase. Gordon West, owner of the West Radio School, is a nationally recognized writer and educator. He teaches his ham classes based on the actual questions in the pool. While the VE program is currently averaging a 48% success rate nationally, a recent West graduating class had an 87% pass rate. (172 students out of 197 administered Element 3 passed!) Clubs that plan license upgrade classes would do well to use West Radio School's manuals, which are based on the VE question pools.

Actually, we will approve any credible amateur-radio operator tests for use in our VE program. Effective January 12, 1987, the volunteer examiner as well as the VEC may select the test questions/answers and design the examinations.

Marty Schwartz KB2LO of AMECO is in the process of releasing revised test manuals which not only have the approved questions, but also multiple-choice questions, answers, and distractors to be used for testing. AMECO's tests, like those of West Radio, use the ARRL multiple-choice questions. Dick Bash also advises he will have testing materials available eventually. A serious problem facing ham-license-preparation publishers is that test questions are sometimes changed, making previous manuals and tests obsolete.

The Paperwork

No one likes paperwork, least of all us. We keep it to an absolute minimum. If the FCC doesn't require it, we don't. And there isn't much that is required. We basically only have four forms:

The FCC Form 610 (Application for Amateur Radio Station and/or Operator License) is, by far, the most important. The other required forms are the Certificate of Successful Completion of Examination, the Manifest of Applicants, and the Examination Test Report.

Only the current version (June, 1984) of Form 610 is suitable for the volunteer testing program and it is very important that it be properly filled out. Our instructions to the VE team cover this. Defective applications cause delays and unbelievable time-consuming work and expense for us.

We issue every volunteer examiner an accreditation card and a distinctive accreditation number. The Manifest of Applicants merely lists the examinees that were tested and their pass/fail results by license class. The Examination Test Report reports the number of applicants that upgraded (or failed to upgrade) and the pass/fail results for each element administered in the examination session.

A Certificate of Successful Completion of Examination has a dual purpose. It is issued to each candidate who scores a passing grade. When the applicant passes a required telegraphy examination for a higher class operator license but fails the required written examination, it serves as evidence for credit for the telegraphy examination at a subsequent examination session held within 365 days of the date of issue.

When the candidate already has an FCC-issued amateur-radio license and scores a passing grade on all examination elements required for a higher class operator license, it serves as evidence that the candidate is authorized to operate on a temporary basis with the rights and privileges of the higher operating class up to 365 days.

Universal "identifiers" are temporarily appended to an applicant's callsign after he upgrades while awaiting receipt of his new license from the FCC. This is so the applicant may immediately begin using newly obtained privileges. On CW, the applicant signs his callsign followed by the slant bar (/) and the designator. On voice, the word "temporary" followed by the identifier is used. The temporary identifiers are:

KT—Technician
AG—General
AA—Advanced
AE—Extra

Temporary operating authority—the so-called "instant-upgrade" privileges—has been extended from 90 days to one year to coincide with the terms of a code credit certificate.

The VE must return the paperwork to the VEC within ten days of test administration, and the VEC must, in turn, return it to the FCC's Gettysburg, Pennsylvania, licensing facility. The paperwork consists of the completed FCC Form 610, a photocopy of the applicant's license, and their answer sheets. (Only the answer sheets. It is not necessary to return the test itself to the VEC.)

Where's the Nearest Exam?

We get several inquiries weekly from amateurs that would like to upgrade and want to know where we are coordinating amateur-radio operator examinations nearby. While we have dozens of examination sessions scheduled, our area of VEC jurisdiction is worldwide. Frequently, we have to advise the applicant to contact our nearest volunteer examiner. If an accredited VE is not nearby, we ask the applicant to locate the closest amateur-radio club or Extra-class amateur and have them get in touch with us so that we can possibly schedule a testing session. For those of you who want to upgrade, we suggest that approach. There really is not examination shortage, merely a shortage of volunteers to administer them.

Be the Testing Authority in Your Area

Amateur-radio operators have always volunteered their services in time of need. Now it is time to help ourselves. Volunteer examiners will have a profound influence on the "health" of the Amateur Radio Service. There was no growth in the service last year—about a third less amateurs upgraded. Growth is important to our future . . . and our country's future.

The VE plays an important role in maintaining the integrity of the volunteer examiner program. Amateur radio can only be as good as its operators, and it is the VE that largely determines who they will be. VEs also bear an important public relations burden. They are expected to be the amateur testing and licensing expert in their area.

If you are an Extra-class amateur-radio operator and would like to participate in the volunteer examiner program, just send us a photocopy of your license and the required signed statement and we will set you up in the amateur testing business at once. Send to: W5YI-VEC, PO Box 10101, Dallas TX 75207. Many VEs give tests on a monthly basis—some before each club meeting. It's really quite easy! Let us hear from you. ■

David Rich
Route 1, Box 9
York NE 68467

The Incredible Digiohm

How to put ten million resistors in the palm of your hand? Build the ultimate substitution box.

Did you ever notice how complicated your life is becoming? Back in the good old days, resistors with a 20% tolerance rating were basic in all electronic circuitry. Through the years we have "progressed" through the 20% to 10% to 5% to 1% tolerance resistors. Granted there are many circuits where the 20% resistors are still used quite extensively, but as we strive for higher precision, lower noise, higher speed, lower cost, etc., we are seeing an increasing use of 1% resistors.

A listing of standard 1% resistor values for values from ten to one million Ohms contains over 480 different resistor values. Not only do you have to purchase a ridiculous number of resistors, but you must also keep them sorted. Have you ever tried to read the color code on a 1%, ¼-W resistor? Next to impossible! If you can read five color bands on a resistor that is only ¼" long, you're in the wrong hobby, you should be a stamp collector. What's the answer to this problem? Read on.

Digiohm, the portable resistance box, was designed to make life simple again. Digiohm is capable of any of ten million resistance values from 0 to 9,999,999 Ohms. Digiohm uses a lever-operated switch to dial in any resistance value. Each of the seven switch sections has ten positions labeled 0 to 9. With the proper connection of 63 resistors to the switch, any of the ten million resistance values can be selected in a matter of seconds just by dialing in the value needed. For less than $20.00 and some junk-box parts (and a little time), you can build Digiohm.

Digiohm's theory of operation is simple: When resistors are connected in series, the total resistance equals the sum of the individual resistances. Fig. 1 shows the schematic diagram of Digiohm. As you can see, there are seven identical decade (10-position) switch sections. Each switch section contains nine resistors. The switch section on the right (ones-unit switch) contains nine 1-Ohm resistors. When the switch is placed in the zero position, current flows directly through the switch without passing through any of the 1-Ohm resistors, and thus the resistance of the first switch section would be zero Ohms.

When the right switch is placed on any value 1 through 9, the corresponding number of 1-Ohm resistors are switched into the circuit to provide the appropriate resistance value.

The switch section second from the right is called the tens-unit switch. The tens-unit switch has nine 10-Ohm resistors connected in series and is capable of the following resistances: 0, 10, 20, 30, 40, 50, 60, 70, 80, and 90 Ohms. The other five

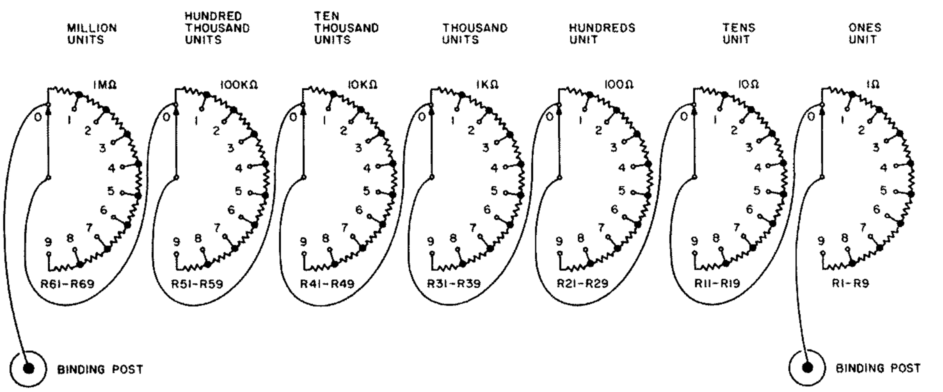


Fig. 1. Schematic.

Dial	Common Connection to:
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9

Fig. 2. Truth table.

switches are similar. Each consists of nine resistors connected in series. See Fig. 1.

Before construction can begin, it will be necessary to purchase or locate the switch assembly, resistors, binding posts, and box. The binding posts and box are not critical and can be purchased locally if you do not have them in your junk box. The resistors are all ¼ Watt, 1% tolerance except for the 1-Ohm resistors, which are 5% tolerance. I used 5% for the 1-Ohm resistors because I had difficulty purchasing 1-Ohm resistors with a 1% tolerance rating at a reasonable price. Nine resistors of each of the values shown in the parts list are required; however, for the small extra cost, it is recommended that ten resistors of each value be purchased. The extra resistor may be necessary to replace a resistor which was damaged during construction.

The switch assembly is the most critical part of Digiohm. The basic switch section is a single-pole ten-position switch with the numbers 0 through 9 indicated. Fig. 2 shows the truth table for the switch. The switch assembly used to build Digiohm is a Digitran model 28531-7. This switch assembly is available from Electronic Design and Sales, as shown in the parts list. The model 28531-7 switch assembly is similar to a thumbwheel switch except that it has miniature levers which are used to operate the switch. The lever-operated switch has a couple of benefits over a thumbwheel switch. First, the switch can be reset to zero with a sweep of the hand, permitting instant reset. Second, the lever operation permits rapid switch setting when compared to the standard thumbwheel switch. Although I have discussed the thumbwheel-type switch, any ten-position switch can be used as long as it matches the truth table shown in Fig. 2.

If you purchase the switch assembly from Electronic Design and Sales, it is likely that it will appear as in Photo A. The switch assembly was originally planned to be installed in medical equipment before being purchased as surplus equipment. As Digiohm does not use multiplexer circuitry in conjunction with the decade switch, it will be necessary to remove the bus wiring. This can be done by cutting the wires between switch sections and using a soldering iron and needlenose pliers to remove the short wire segments. It is a good idea to pull the short wire segments from the side opposite the conductor so that the conductor is not accidentally pulled from the board. After the wires have been removed, it will be necessary to remove the excess solder from the holes.

After the switch has been prepared, the resistors can be inserted and soldered to the switch. Fig. 3 shows the resistor connection. During construction you will dis-

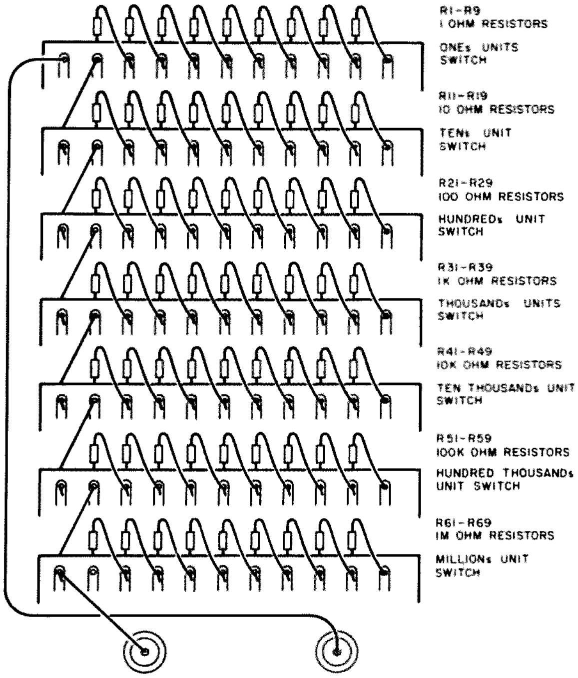


Fig. 3. Back view of the switch assembly showing resistor layout and connection.

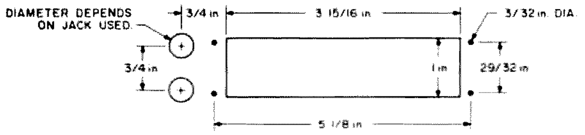


Fig. 4. Cutout dimensions.

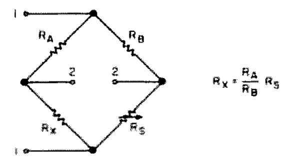


Fig. 5. Digiohm can be used as Rs in a Wheatstone-bridge circuit.

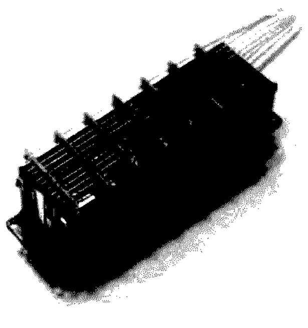


Photo A. Switch assembly with bus wiring.

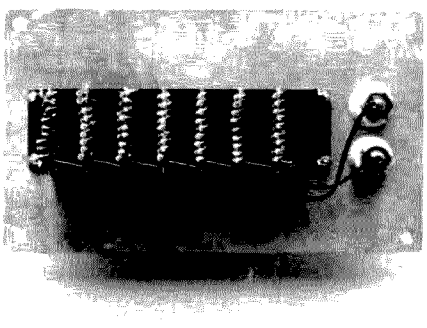


Photo B. Switch assembly with resistors and wiring installed.

cover why ¼-Watt resistors were specified: ¼-Watt resistors fit quite nicely, whereas ½-Watt resistors would have been more difficult to install. Some care should be taken when bending the resistor leads, as they can break from the resistor body.

After you have finished soldering the 63 resistors, you'll be ready for a change. The next step is to cut out the front panel for the mounting of the switch assembly and the binding posts. Fig. 4 shows the cutout dimensions. Layout is not critical. Before drilling holes for the binding posts, check their diameter.

The next step is to mount the switch assembly and the binding posts. After you have mounted the switch assembly and binding posts, you will need to solder the two wires as shown in Photo B.

You are now ready to check out Digiohm. Connect an ohmmeter to the binding posts and set the ohmmeter to the lowest resistance range. With all the switches on Digiohm set to zero, the ohmmeter should read zero Ohms. Next, move the rightmost switch (ones-unit switch) through every position while watching the ohmmeter reading. The ohmmeter should correspond to the value set on Digiohm. After you have checked out the ones-unit switch, return it to zero and check the remaining switches in a similar manner. It will be necessary to set the ohmmeter to the appropriate range and zero it before checking each section.

If you run across a problem, it will most likely be a poor solder joint or the installation of a resistor with the wrong value. By using the above checkout, you should be able to locate the problem without much difficulty.

After you have completed the checkout and have made any required corrections, the front panel can be mounted. I used ½" rub-on vinyl letters to write the word Digiohm on the front panel. Photo C shows the finished product.

In addition to using it as a resistance substitution box, Digiohm can be used as Rs in the Wheatstone bridge shown in Fig. 5.

Whenever using Digiohm, you must be aware of its electrical specifications. Since ¼-Watt resistors are used, care must be taken not to exceed their rating. The Digitran model 28531-7 switch is rated for maximum switching of 28 volts ac or dc and 50 milliamps of resistive current. In the non-switching mode, the switch is rated at 1 Amp. The switch has a dielectric rating of 500 volts rms. These ratings are typical for thumbwheel-type switches.

If you build the Digiohm, you will find that it is a welcome addition to any hobbyist's bench. Good luck and happy switching. ■

Parts List

All resistors are ¼ Watt

R1-R10	1 Ohm, 5%
R11-R20	10 Ohms, 1%
R21-R30	100 Ohms, 1%
R31-R40	1000 Ohms, 1%
R41-R50	10,000 Ohms, 1%
R51-R60	100,000 Ohms, 1%
R61-R70	1,000,000 Ohms, 1%

Note: Only nine resistors of each value are required for the project (see text).

J1-J2—binding posts, Radio Shack #274-662 or equivalent

S1—switch assembly, ten position, seven sections. Digitran switch model 28531-7 or equivalent (see text)

Box—Radio Shack #270-627 or equivalent size, 6¼" × 3¾" × 2"

The following is available from Electronic Design and Sales, PO Box 502, Columbus NE 68601: Digitran model 28531-7—$13.00, ten resistors of each value—$4.00, complete Digiohm assembled—$59.95; Nebraska residents add 3½% sales tax. Please include $2.50 for postage and handling.

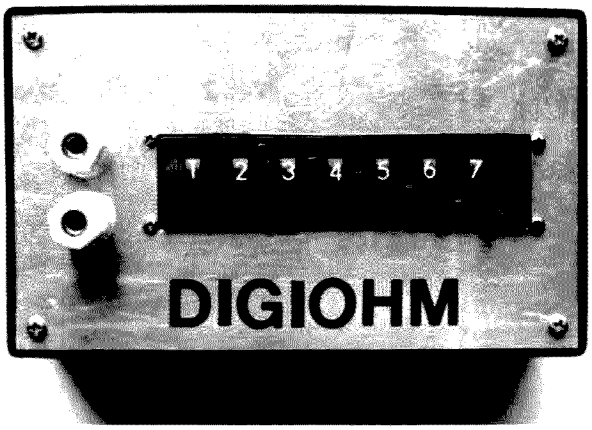


Photo C. The finished product.

Robin Rumbolt WA4TEM
1134 Glade Hill Drive
Knoxville TN 37919

Speech! Speech!

Here's a talking repeater controller that you can build in no time at all. It gives a whole new meaning to the word "vox"!

This project began as a voice identifier for one of our local repeaters. We wanted the ability to have several voice ID messages given at proper times during repeater operation.

After the ID software had been written, I noticed that only a little additional hardware and software would be needed to completely replace the repeater timer

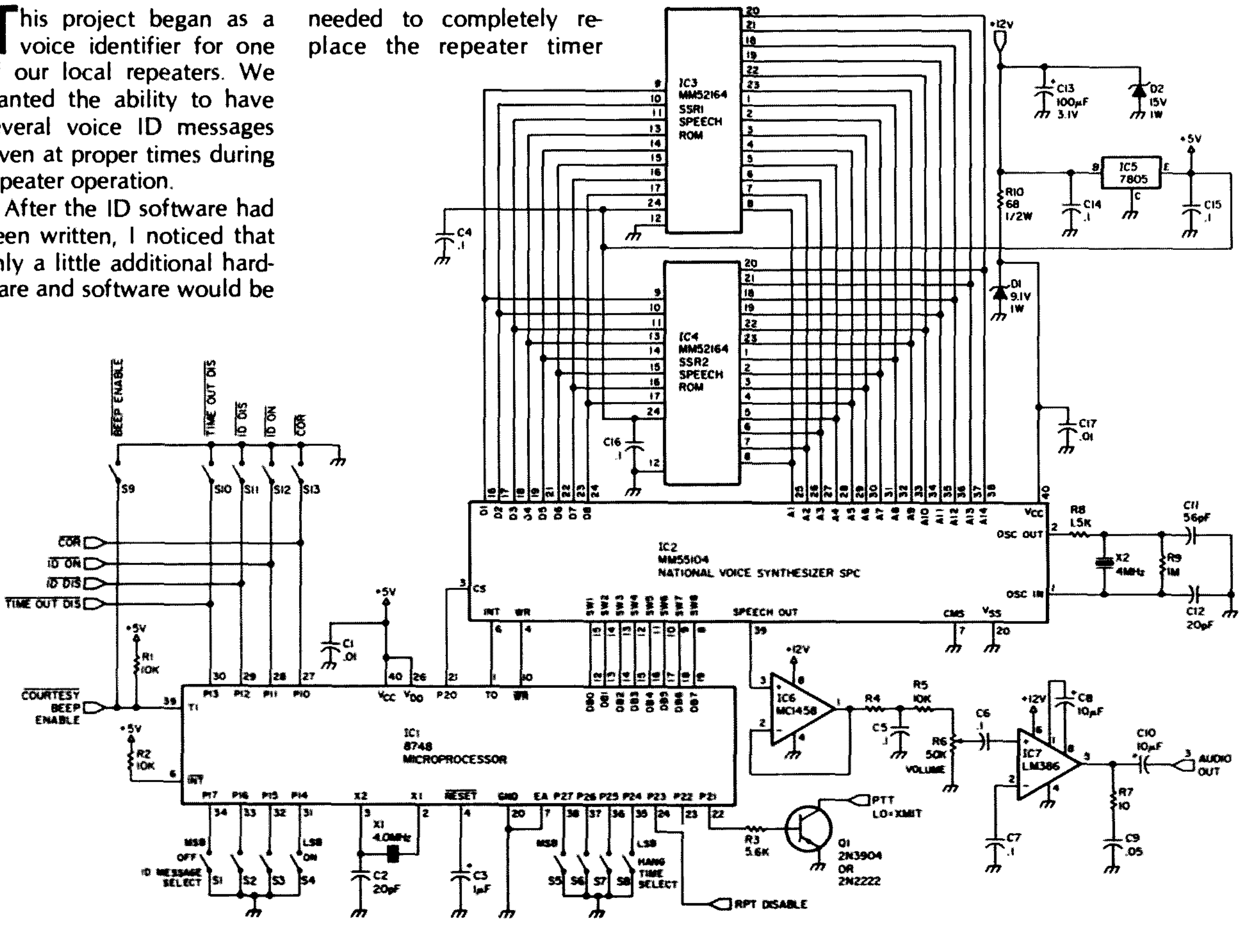


Fig. 1. Microprocessor repeater interface and identifier.

board in the all-Motorola repeater. I added what was needed to fully implement the repeater timer and squelch-tail timer functions, and the circuit ended up with the following features:

1) Voice ID with up to 15 switch-selectable messages. Each message can be individually selected or the messages will automatically cycle through, giving a different ID each ID period.

2) ID interval set in software. Ours is set to 9 minutes 45 seconds, but the period can be set to any length up to 255 seconds in 1-second increments.

3) Repeater time-out timer. Time-out time set in software. We set ours to 2 minutes, but any length up to 255 minutes may be specified in 1-second increments.

4) Time-out messages. Ours says "Time out is near" at 15 seconds before time out. Then at 2 seconds before time out, it says "Over and out!" Times and messages may be changed in software.

5) Adjustable hang timer. DIP switches allow selection of hang times in 0.5-second increments from 0 to 7.5 seconds.

6) Courtesy beep at the end of the hang time.

7) Independent disable lines brought out for all functions.

8) Single-supply +12-volt operation.

The Circuit

The circuit shown in Fig. 1 is built around just two major components, the Intel 8748 microprocessor and the National Digitalker chip set. The microprocessor handles all the timing and message-storage jobs while the Digitalker does the actual voice synthesis.

The Digitalker chip set contains a voice-synthesizer chip, the MM55104, and two speech ROMS which contain the data necessary to generate 143 different words and phrases. A word list showing the words available in the basic chip set is shown in Fig. 2. Two op amps are connected to the output of the voice synthesizer to provide for speech filtering and audio amplification to speaker-level audio. Since speech is digitally constructed in the Digitalker, the output needs to be low-pass filtered to remove extraneous digital noise and high-frequency by-products. This filtering helps the speech to sound more natural. Without it, the speech tends to sound somewhat garbled.

The 8748 microprocessor has attached to it three sets of DIP switches. The first set, S1–S4, is used to select the ID message to be sent at ID time. The second set, S5–S8, is used to select the hang-time length. The last set, S9–S13, is used for function controls. The micro has internal pull-up resistors for most of the lines going to the switches, so only one line, pin 39, needs external pull-up, provided by resistor R1. All lines going to the micro are TTL-compatible, so standard negative-true logic was adopted. That is, grounding a line causes its function to occur.

The function lines out of the processor allow you to control what it does. The COR line is the most important. It connects, with proper interface, to your repeater receiver. Bringing it low triggers all functions done by this circuit. The ID ON line enables you to have the micro continuously send the ID message you have selected with DIP switches S1–S4. The ID DISABLE line prevents ID generation

Word	Hex Address	Word	Hex Address	Word	Hex Address	Word	Hex Address
THIS IS DIGITALKER	00	D	23	320 MS SILENCE	47	MILLI-	6C
ONE	01	E	24	CENTI-	48	MINUS	6D
TWO	02	F	25	CHECK	49	MINUTE	6E
THREE	03	G	26	COMMA	4A	NEAR	6F
FOUR	04	H	27	CONTROL	4B	NUMBER	70
FIVE	05	I	28	DANGER	4C	OF	71
SIX	06	J	29	DEGREE	4D	OFF	72
SEVEN	07	K	2A	DOLLAR	4E	ON	73
EIGHT	08	L	2B	DOWN	4F	OUT	74
NINE	09	M	2C	EQUAL	50	OVER	75
TEN	0A	N	2D	ERROR	51	PARENTHESIS	76
ELEVEN	0B	O	2E	FEET	52	PERCENT	77
TWELVE	0C	P	2F	FLOW	53	PLEASE	78
THIRTEEN	0D	Q	30	FUEL	54	PLUS	79
FOURTEEN	0E	R	31	GALLON	55	POINT	7A
FIFTEEN	0F	S	32	GO	56	POUND	7B
SIXTEEN	10	T	33	GRAM	57	PULSES	7C
SEVENTEEN	11	U	34	GREAT	58	RATE	7D
EIGHTEEN	12	V	35	GREATER	59	RE-	7E
NINETEEN	13	W	36	HAVE	5A	READY	7F
TWENTY	14	X	37	HIGH	5B	RIGHT	80
THIRTY	15	Y	38	HIGHER	5C	-SS (makes plurals)	81
FORTY	16	Z	39	HOUR	5D	SECOND	82
FIFTY	17			IN	5E	SET	83
SIXTY	18	AGAIN	3A	INCHES	5F	SPACE	84
SEVENTY	19	AMPERE	3B	IS	60	SPEED	85
EIGHTY	1A	AND	3C	IT	61	STAR	86
NINETY	1B	AT	3D	KILO	62	START	87
HUNDRED	1C	CANCEL	3E	LEFT	63	STOP	88
THOUSAND	1D	CASE	3F	LESS	64	THAN	89
MILLION	1E	CENT	40	LESSER	65	THE	8A
ZERO	1F	400 Hz TONE	41	LIMIT	66	TIME	8B
		80 Hz TONE	42	LOW	67	TRY	8C
		20 MS SILENCE	43	LOWER	68	UP	8D
A	20	40 MS SILENCE	44	MARK	69	VOLT	8E
B	21	80 MS SILENCE	45	METER	6A	WEIGHT	8F
C	22	160 MS SILENCE	46	MILE	6B		

Fig. 2. Digitalker master word list.

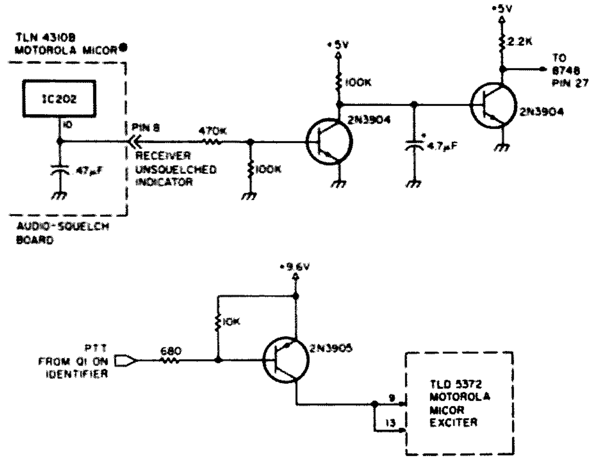


Fig. 3. The Motorola Micor receiver-to-microprocessor interface (top) and the identifier-exciter PTT interface.

whenever it is grounded. The TIME-OUT DISABLE line will defeat the internal time-out countdown and enable Q1 to stay enabled for as long as the COR line is held low.

The RPT DISABLE line is really powerful, as it should be. Whenever it is brought low, Q1 is immediately turned off and all functions are disabled. This line may also be used as a system reset. The BEEP ENABLE line, when grounded, allows the courtesy beep to occur at the end of the hang-time period.

Remember that with exception of the PTT line from Q1, all of these lines are limited to a maximum voltage of 5 volts, so be careful when interfacing this circuit into your repeater system. Although all of these lines are connected to on-board DIP switches for local control, they may also be connected to external, open-collector, TTL-level devices for remote control. When using external control, make sure that all on-board DIP switches are set to their open, or off, positions.

Construction and Operation

Our prototype circuit was built on a Vector 3677-2 DIP plugboard for ease of mounting in our repeater. I highly recommend building the circuit on plug-in boards. It surely makes debugging easier! Sockets were provided for all ICs. Since the circuit draws about 200 mA at 12 volts, a small TO-220-style heat sink was provided for the 5-volt regulator, IC7. Also note the 15-volt, 1-Watt zener across the 12-volt bus. That little diode, placed on each board in the repeater system, has saved my backside several times when lightning hit or when the main-supply pass transistor in the repeater shorted out. I highly recommend its use.

After the circuit is wired, check it over carefully several times. If possible, have a friend check it too. There isn't much to it, but the ICs are expensive, so don't take a chance.

After checking the wiring and before you insert the ICs in their sockets, check the power-supply voltages. Once you're satisfied that all is in readiness, set all DIP switches to their open position, plug in the ICs, attach a speaker, and apply power. The circuit should wake up with a short burst of unintelligible speech followed by silence.

Next, close all of the ID MESSAGE SELECT switches. Then close the ID ON switch. The circuit should then cycle through the ID messages that have been preprogrammed into the processor. If all is OK thus far, congratulations! The rest of the functions should now also work as advertised. You're ready to interface the circuit into your repeater.

Obviously, I can't show you how to interface to all equipment, but Fig. 3 shows the interface we used between the circuit and the Motorola Micor® audio-squelch and transmitter-exciter boards in our system.

Once interfaced into your system, all you'll need to do now is set the HANG-TIME SELECT switches. They are set in binary. First, determine the number of half-seconds of time desired. Then consult the chart in Fig. 4 for the proper switches to close. If all switches are open, there will be no squelch tail. The PTT will follow the COR signal immediately.

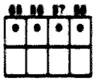
Here's how the system operates once successfully interfaced. When the receiver senses an incoming signal, it pulls the COR line low. Two events then occur. First, the PTT transistor is turned on to enable the repeater transmitter. Second, the ID interval timer is started and will continue to run until it times out. Voice ID is then certain to occur unless disabled by the ID DISABLE line, regardless of the state of the COR line.

When the COR line is released, or brought high again, the hang-time countdown is begun. When this countdown is complete (at a time set by the HANG-TIME SELECT switches), the processor turns off Q1, thereby turning off the transmitter. If the courtesy-beep line has been tied low, the processor will also command the voice synthesizer to send a short beep of 400-Hz tone. If the COR line is held low, about 15 seconds before

Parts List

Resistors		
R1, R2, R4, R5	10k, ¼ W, 10%	$ .24
R3	5.6k, ¼ W, 10%	.06
R6	Potentiometer, 50k	.59
R7	10 Ohm, ¼ W, 10%	.06
R8	1.5k, ¼ W, 10%	.06
R9	1 M, ¼ W, 10%	.06
R10	68 Ohm, ½ W, 10%	.06
Capacitors		
C1, C17	.01 uF, disc ceramic, 50 V	.40
C2, C12	20 pF, disc ceramic, 50 V	.40
C3	1.0 uF, electrolytic, 15 V	.59
C4-7, C14-16	0.1 uF, disc ceramic, 50 V	1.40
C8, C10	10 uF, electrolytic, 15 V	1.18
C9	.05 uF, disc ceramic, 50 V	.20
C11	56 pF, disc ceramic, 50 V	.20
C13	100 uF, electrolytic, 15 V	.69
IC1	Microprocessor, Intel 8748	*
IC2-4	National Digitalker chip set	35.00
IC5	LM7805 voltage regulator, 5 V	.79
IC6	MC1458 dual op amp	.59
IC7	LM386 power op amp	.89
D1	Zener diode, 9.1 V, 1 W	.25
D2	Zener diode, 15 V, 1 W	.25
Q1	Transistor, NPN 2N3904 or equivalent	.25
X1, X2	Crystal, 4.0 MHz	7.90
S1-S4, S5-S8	DIP switch, SPST, 4 position	2.38
S9-S13	DIP switch, SPST, 8 position	1.49
	PC board	*
	Socket, 40-pin DIP (two)	.98
	Socket, 24-pin DIP (two)	.66
	Socket, 8-pin DIP (two)	.32
	Heat sink, TO-220 style	.25

* Available from author



S5	S6	S7	S8	Hang Time
0	0	0	0	0.0 sec.
0	0	0	1	0.5
0	0	1	0	1.0
0	0	1	1	1.5
0	1	0	0	2.0
0	1	0	1	2.5
0	1	1	0	3.0
0	1	1	1	3.5
1	0	0	0	4.0
1	0	0	1	4.5
1	0	1	0	5.0
1	0	1	1	5.5
1	1	0	0	6.0
1	1	0	1	6.5
1	1	1	0	7.0
1	1	1	1	7.5

Fig. 4 Hang-time switch settings.

time out a warning message will be sent by the voice synthesizer: *Time out is near.* At two seconds before time out, a second, final warning will be given: *Over and out!* The PTT output will then be deactivated until either the COR line is released and brought low again or the ID cycle is completed, at which time a voice ID message will be given and the PTT output deactivated again.

Holding the COR line low past time out will keep the transmitter off, but automatic ID with PTT activation will still occur at the end of every succeeding ID interval. If the synthesizer is speaking when the ID message is due, the ID message will immediately follow.

Messages

Although the word list seems at first glance to be somewhat limited, a little applied ingenuity can work wonders. For example, a sound-alike to the word "repeater" can be made by splicing the word "meter" (hex 6A) onto the utterance "re-" (hex 7E) to form "re-meter." The difference is hardly noticeable on the air, especially if your users' minds are listening for the word "repeater"!

When we wanted to put in the phrase "high over East Tennessee," we used two splices. "East" was made up of the letter "E" spliced with the sound "SS" (hex 81). "Tennessee" was formed with "ten," "SS," and "C." Sneaky, huh?

Also, don't forget that many words can serve double duty such as "weight" and "wait," "one" and "won," "hour" and "our," "C" and "sea," "I" and "eye," etc. I am sure you can come up with many more.

Software

I thought long and hard about publishing the software I used, but decided not to do it. Since messages and times must be customized for each repeater owner's wishes, various addresses, pointers, and constants must be precisely programmed. How to determine them would be beyond the scope of this article. I will, however, furnish preprogrammed and customized microprocessors for a modest sum.

A version of software is also available for ID-only operation with no timers except those needed for identifier operation.

Conclusion

Voice synthesizers are becoming increasingly popular on repeaters across the country. This circuit provides an inexpensive way to add voice to your repeater, to demonstrate the claim that your repeater is "microprocessor controlled," and to eliminate those old and sometimes unreliable 555 timer circuits. For those who are interested, PC boards and microprocessors are available from the author.

I would like to thank Sam Kirby WB4HAP for building the prototype of this circuit and offering his repeater as the proving ground for its operation.■

Philip Schmitt WA8JXE
1940 Howard Street, #455
Kalamazoo MI 49008

So Why Do They Call It Wireless?

One easy antenna. Five hot bands. Need we say more?

The centerfed multiband antenna—a favorite with amateurs in the 30s, 40s, and 50s—is enjoying a rebirth in the 80s. The need for frequency versatility (given today's crowded band conditions, especially on 80 and 40 meters) and a modern, simpler design approach to antenna couplers have been the two predominant factors responsible for the renewed popularity of this antenna.

It is unfortunate, however, that most technical literature on this antenna is outdated. Few amateurs today, for example, couple their balanced-line antennas inductively to the transmitter tank coil or use antenna-matching systems that require changing coils or coupling configurations when changing bands. In addition, many of the suppliers of open-wire feedline cited in past literature are no longer in business. Therefore, I have attempted to share in this article a modem design approach to the centerfed multiband antenna which I have gleaned from a review of literature, catalog inquiries, experimentation, and discussions with other amateurs.

Antenna Design and Characteristics

Traditionally, the centerfed multiband antenna is cut at 1/2 wavelength for the lowest desired band. Operation on all higher bands thus will be on multiples of 1/2 wavelength. For example, an antenna cut for 1/2 wavelength on 80 meters will appear as 1 wavelength on 40 meters, 2 wavelengths on 20 meters, 3 wavelengths on 15 meters, and 4 wavelengths on 10 meters. Cutting for 1/2 wavelength at the lowest operating frequency has become accepted practice because the voltage and current distribution, and hence the impedance and radiation patterns, are more easily predicted at multiples of a half wavelength. See Fig. 1 for construction practices and Fig. 2 for radiation pat-

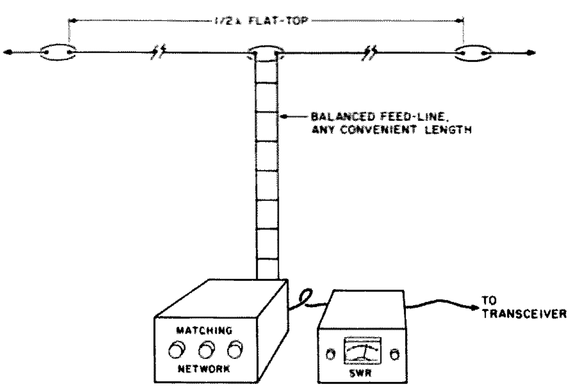


Fig. 1. Full-size version of the centerfed multiband antenna, cut for the lowest band of operation.

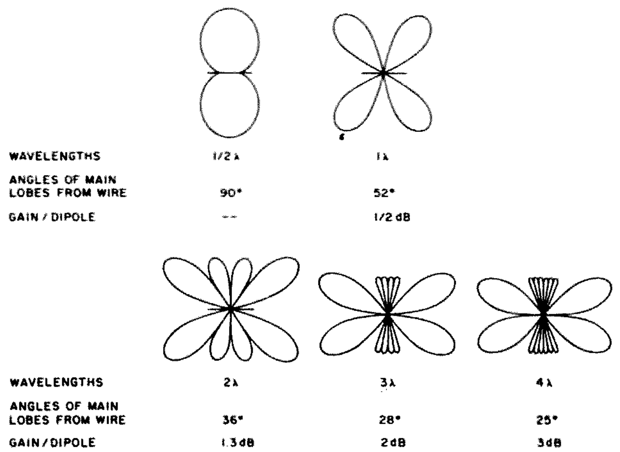


Fig. 2. Characteristics of the antenna.

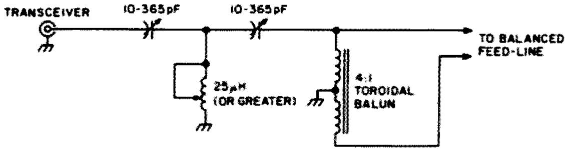


Fig. 3. A T-network with a 4:1 toroidal balun for use in coupling modern transceivers to balanced feedlines.

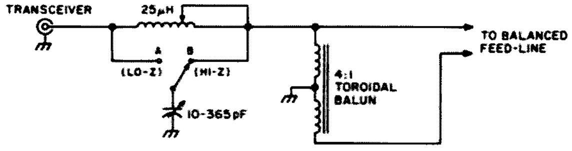


Fig. 4. An L-network coupler for use with balanced feeders.

terns and gain characteristics of this antenna for the 80-10-meter amateur bands.[1,2]

In limited-space situations where it is not feasible to erect a full 1/2-wavelength antenna, the antenna can be shortened and still be effective as long as the total length of half the antenna plus one feeder wire add up to at least 1/4 wavelength at the lowest frequency.[3] In the case of a shortened antenna, a field-strength meter can be used to obtain an approximation of the radiation pattern. The impedance, of course, need not be calculated as long as the antenna-coupling network presents a satisfactory (resistive) load to the transmitter.

Turning to the subject of balanced feedlines for this antenna, there are two popular alternatives. One is to use open-wire line, the other is to use plastic-jacketed twinlead cable. Open-wire line is just that—two parallel exposed wires held apart by ceramic or plastic spacers. It is available in 300- and 450-Ohm impedances.

Four current suppliers of open-wire line are: Radiokit, Box 411, Greenville, New Hampshire; Kilo-tec, Box 1001, Oak View, California; Madison Electronics, 1508 McKinney, Houston, Texas; and Texas Towers, 1108 Summit Avenue, Suite 4, Plano, Texas.[4] Plastic-jacketed television twinlead is readily available in almost all electronics stores and is generally acceptable for transmitters with outputs of 250 Watts or less. Belden makes a heavier-duty twinlead specifically for transmission purposes which is rated at 1 kW. Their product number for this twinlead is 8235.

The decision to employ open-wire line or twinlead should be made after considering the relative advantages and disadvantages of each. Open-wire line has the lowest loss but is less rugged and more difficult to support than twinlead. In addition, since the wires are not insulated, care should be taken not to route open-wire line where people could inadvertently come in contact with it. Twinlead, on the other hand, has greater loss, especially when wet. It is easier to route, however, as high-quality, TV-type standoffs can be used. Also, the heavy-duty twinlead is exceptionally rugged. (I have used the same heavy-duty twinlead at my Michigan QTH for ten years, where it has been exposed to ice, high winds, and low temperatures.)

The Antenna-Coupling Network

Prior to about 1970, most amateurs either coupled their transmitters to balanced lines through pi-network output stages and air-wound coil baluns or used various switchable series and parallel antenna-coupling networks. Today, with the advent of solid-state transceivers which require a nominal 50-Ohm resistive load for the antenna, an external antenna-coupling network is necessary to couple to 300- or 450-Ohm balanced lines.

The matching network almost universally used today is the T-match with a 4:1 toroidal balun. (It was largely the availability of the compact toroidal balun, which can easily be enclosed in the antenna-coupler chassis box, that led to the wide acceptance of this design by amateurs.) An experimental T-network coupler that I assembled from surplus parts is shown in Fig. 3.[5] Various modifications of this design are used in most kit or assembled "antenna tuners." (The term "antenna tuner" was not used in this article as it is actually a misnomer. A more accurate term for this device would be an "antenna-coupling network," since its primary purpose is to couple or match the line/antenna to the nominal 50-Ohm load requirements of the transceiver.)

To use the T-network coupler, first set both variable capacitors to a half-open position. Then, using low transmit power (5 or 10 Watts in the "tune" position), tap the inductor a winding at a time until a dip in swr is indicated. After the proper coil winding is tapped, alternately adjust the two capacitors for the lowest swr. If the swr is less than 1.5:1, apply full power to the coupler since the tuning process is now complete.

An Alternate Coupling Network

The reversible L-network, with the addition of a 4:1 toroidal balun, can also be used to match 300- or 450-Ohm balanced lines. The L-network requires only one variable capacitor, unlike the T-network which requires two. The trade-off in using the L-network over the T-network is that the Q of the L-network is less uniform over the coupling range. This presents little problem, however, if harmonic attenuation of the transmitter is sufficient. (Transmitters and transceivers marketed in 1979 or later generally have sufficient harmonic attenuation, as federal law mandated stricter emission and radiation standards about this time.) An experimental L-network that I built is shown in Fig. 4.

To use the L-network, select tap A for low impedances and tap B for high impedances. Next, select the coil tap that indicates minimum swr; then fine-tune the variable capacitor for the lowest swr. If the swr is less than 1.5:1, switch the transceiver from tune to full power since the tuning process is now complete.

Antenna-Coupler Construction Practices

For the amateur who has not constructed antenna-coupling units before, a few words about the subject are in order.

First of all, it might be helpful to know that complete information on winding toroidal baluns (along with a list of parts suppliers) can be found in almost any late edition of the ARRL handbook.[6] The appropriate section of the book will be listed in the index under "baluns."

To construct the air-wound coils required by the two antenna couplers, it is important to know the required coil radius, the coil length, and the number of coil turns for a given inductance. A formula to approximate the inductance of air-core coils is:

$$L = a^2n^2/(9a + 10b)$$

where L = inductance in microhenrys, a = coil radius in inches, b = coil length in inches, and n = number of turns.[7]

Regarding the selection of variable capacitors for

the T- and L-networks, I found that the common air-dielectric variable capacitors used in older broadcast-band superhets work well in antenna couplers if the transmitter power output is less than 50 Watts. For higher-power transmitting applications, air variables with wider plate spacings are needed. These transmitter-type variables usually can be found at hamfests or can be purchased from larger amateur-radio supply houses.

A formula that can be used to calculate the capacitance of an unknown variable capacitor is:

$$C = .224KA/d \times (n-1)$$

where C = capacitance in pF, K = dielectric constant of material between plates (use 1.0 for air), A = area of one side of one plate in square inches, d = separation of plate surfaces in inches, and n = number of plates.[7]

Breakdown ratings for common air-gap variable capacitors can be easily calculated, since the breakdown voltage for air-dielectric capacitors is given as from 19.8 to 22.8 volts per mil (.001 inch).[8] This information is obviously useful when tube-type linears are used ahead of the antenna tuner. ■

References

1. Sentz, Robert E., *Modern Communications Electronics*, San Francisco, Rinehart Press, 1971, Chapter 8.
2. *The ARRL Antenna Book*, Thirteenth Edition, American Radio Relay League, 1977, Chapter 2.
3. *Understanding Amateur Radio*, Second Edition, American Radio Relay League, 1976, Chapter 15.
4. Welsh, Bill, "Novice," *CQ*, March, 1983.
5. Schultz, John, "Using a T-Network," *CQ*, May, 1968.
6. *The Radio Amateur's Handbook*, Fifty-third Edition, American Radio Relay League, 1976, p. 581.
7. *Ibid.*, p. 26.
8. *Ibid.*, p. 24.

John Abbott K6YB
PO Box 66
Newhall CA 91322

Cheap Heath Help

Is your HW-101's offset off? Try this four-dollar fix. Without it, you're being cheated out of QSOs.

The original HW-100 transceiver (Photo A) and its cousin, the HW-101, both use a 1-kHz "transmit offset" for CW operation. This of course means that you will transmit on the same frequency (zero beat) as the CW station you are receiving only if you tune the transceiver so as to hear the incoming station with a 1-kHz audio CW note or "offset," as shown in Fig. 1. However, CW operation is generally carried on with a receiver bandpass of 750 Hz or less, which is one of the reasons you can enjoy less QRM and QRN on CW than on SSB.

However, if you tune your receiver so as to hear a tone of less than 1 kHz, you may transmit outside the receiver bandpass of most stations that you call, since you will be transmitting 1 kHz above where you are listening. Thus, if you add an external audio CW filter to your transceiver so that you listen to incoming CW signals at approximately 500 Hz, then with a 1-kHz offset you will transmit 500 Hz higher in frequency than the station you are receiving, as shown in Fig. 2. If this station is also using a 1-kHz offset, he will be trying to receive you at 1.5 kHz, which may be far outside his audio bandpass if he is using a 750-Hz bandpass CW filter for receiving. The result will be very few QSOs!

Reducing the Transmit Offset

The solution to this prob-

Photo A. The HW-100 with added Swan dial and audio-response control on the upper right. The small toggle switch on the lower right controls an external antenna relay.

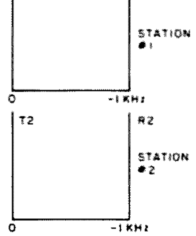


Fig. 1. Two CW stations both using a 1-kHz transmit offset with transmitters T1 and T2 zero beat in frequency. There is no difficulty in communication unless one station reduces his received bandwidth to less than 1 kHz using an audio CW filter.

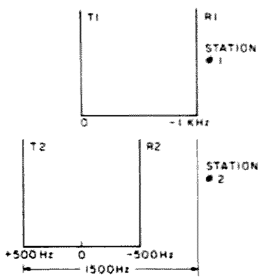


Fig. 2. Two CW stations, both using a 1-kHz transmit offset but with station #2 listening to a 500-Hz tone which places his transmit frequency so that station #1 must listen to a 1500-Hz tone. If station #1 is using a 750-Hz bandpass audio filter, he may not hear station #2.

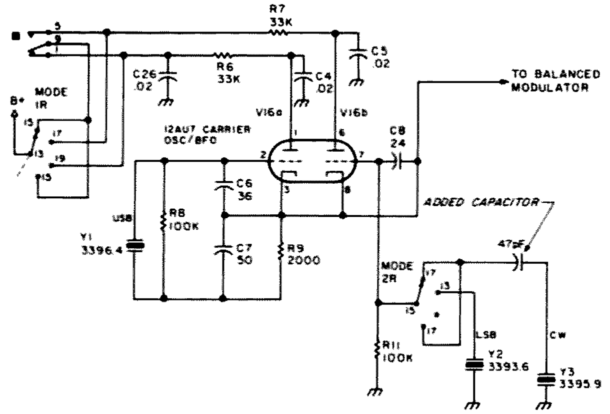


Fig. 3. Carrier-oscillator schematic illustrating added 47-pF capacitor.

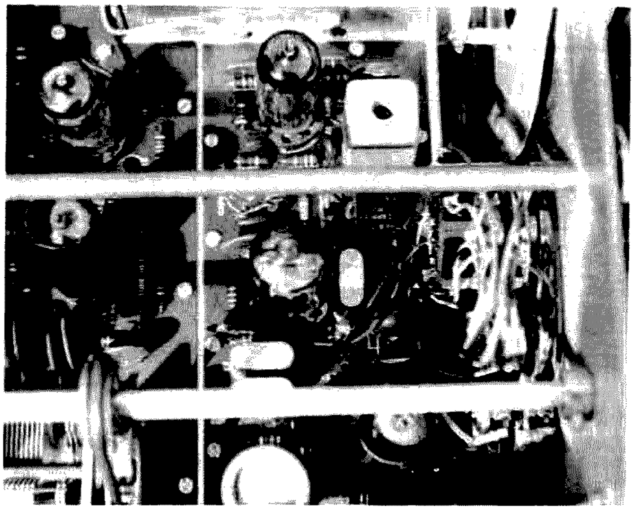


Photo B. The location of the 47-pF capacitor between point "22" on the circuit board near Y3 and the Mode switch.

lem is to change the CW transmit offset from 1 kHz to 500 Hz. I did this very cheaply and easily by inserting a 47-pF capacitor (Radio Shack #272-121) between the front-panel Mode switch and CW transmit crystal Y3 on the modulator circuit board next to V16, as shown in Photo B. I did this by removing the wire to Y3 from the Mode switch and by soldering one lead of the 47-pF capacitor to the Mode switch where the wire to Y3 was formerly located, using a short spaghetti-covered lead. I then soldered the wire from Y3 to the other shortened lead of the capacitor and covered the joint with spaghetti. Fig. 3 illustrates the circuit change schematically.

What I did with this modification was to retune Y3 upward 500 Hz, from 3395.4 kHz to 3395.9 kHz. The transmit offset is the difference between the frequency of USB crystal Y1 used for receiving on CW at 3396.4 kHz and the frequency of Y3 which is now 3395.9 kHz, or 500 Hz. After this simple modification, I had much better luck raising another CW station. Also, I could now go ahead and use a 750-Hz audio bandpass filter for improved CW reception without any problem.

Additional Modification

An additional modification that I made was to change the frequency of the 1-kHz tone oscillator used for CW monitoring and VOX keying to 500 Hz. This modification is a little more difficult. I had to remove the PEC (printed electronic circuit) board (Heath #84-22) on the audio circuit board near V15 and replace it with a homemade PEC. I obtained a printed-circuit experimenters' board (Radio Shack #276-158) and cut a piece of it to the same size as the original PEC. I also obtained five 0.001-uF capacitors (Radio Shack #272-126) and four 470,000-Ohm, ¼-Watt resistors (Radio Shack #271-1354). I mounted them as shown in Fig. 4 on the small board, being careful to locate the three pigtails in the same location as the old PEC pigtails. I then replaced the old PEC with the new one shown in Photo C. Note that V15 is removed so you can see the board clearly.

What I did with this modification, shown schematically in Fig. 5, was to retune the frequency of the audio phase-shift oscillator, V15A, from 1 kHz to approximately 500 Hz so that now when I transmit on CW, the monitor tone I hear is at approximately the same frequency as the CW station I am listening to. This helps me to make sure that I am transmitting at the correct frequency, so I can be zero beat with the received CW signal.

Results

The total cost of these two modifications was approximately $3.90, excluding sales tax. The CW operating benefit, as far as answers to my calls, has been greater than adding a kW

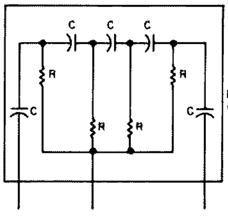


Fig. 4. Homemade PEC.

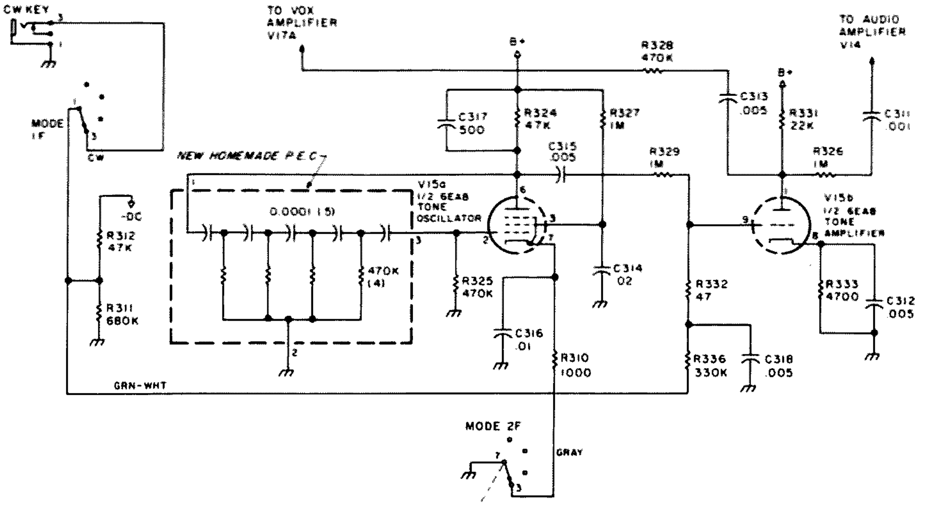


Fig. 5. Tone-oscillator schematic illustrating new homemade PEC.

LETTERS

RIG HR IS...

Just thought I'd drop you a line and let you know I thought your December editorial was right on target. I spend quite a few enjoyable hours every week SW DXing and, while I'm not a ham, I do read *73* from time to time and enjoy your editorials and some of the articles that can be applied to the SWL.

The most important reason I've never felt the urge to get into amateur radio is precisely because of what I hear on the ham bands (or rather I should say because of what I *don't* hear). I hear a lot of nice folks doing a lot of talking, but hardly any of them have anything at all to say! I would say 90% or better of what I've heard has been solely about equipment, equipment, and more equipment.

Wayne, this might come as a surprise to a lot of hams out there, but amateur radio is about *expanding* communication. It's not an end in itself. I'd certainly defend their right to yak about their equipment until the cows come home, but I can't see spending a lot of money and time on ham stuff, knowing there won't be any interesting people to talk to.

Wm. Burke
Richmond VA

NO ENCOURAGEMENT

It was with more than a little interest that I read "Never Say Die" in the November, 1984, issue, and I feel compelled to offer my two cents worth.

I received my Novice license after first seeing a flyer advertising ham radio and then attending a Novice class sponsored by the local radio club. I enjoyed the classes and had little difficulty with CW (unlike some others). I guess it was exasperating to most: "I'm going to toss that key as far as I can as soon as I upgrade" was often heard.

The fact that I have grown to like CW and think it's great is not the reason for this letter, though. I don't really know if the hobby would gain or lose with no-code licensing. What prompted me to write was reading that amateur radio seems to be having a hard time attracting newcomers. This doesn't surprise me in the least. If it were not for my own strong interest in radio and electronics, I would have dropped out of hamming months ago. The reason?

After I acquired my Novice license, I began attending the meetings at the local radio club. I even paid the $10.00 membership dues; I was eager to learn about my newly-acquired hobby and eager to get on the air. Financial limitations necessitated acquisition of my equipment piecemeal.

I quickly learned that: (1) Anyone inquiring about a *receiver* was odd, at best; (2) anyone expressing a desire to build his own equipment was probably a bit addled; (3) definitely don't remain a Novice any longer than necessary—maybe two or three weeks.

As time went on, I acquired enough equipment to get on the air and did so. At this point it wasn't easy, but I read a lot, and with plenty of anecdotes and television parts from Doyle W0SOM, I built what I needed (antenna, T/R switch, power supply, etc.) and got a reliable rig going on 40 meters (so far, I've worked thirty-six states).

I do not regret for a moment the fact that I received no encouragement or support from my local radio club, as I have learned a great deal, mostly the hard way. I do, however, feel a lack in my amateur experience, which brings me, now, to the point of my letter. New hams need all the help and encouragement they can get. Without it, it can be rough going at times (as probably most any ham can tell you), and if the clubs have the kind of attitude I encountered, they'll need a pretty strong motivation to stay in the hobby instead of just chucking it in disgust.

I do wonder if my experience is unique, and I hope it is, because otherwise amateur radio has problems.

Jon Danford KA0SOV
Joplin MO

PR GAMBIT

The convincing reason to learn, know, and use International Morse code is to defeat the language barrier in the international hobby/service of amateur radio.

It is one of the few ways you can communicate with the average Japanese technician. There must surely be others who have been to Japan and carried on an eyeball QSO almost entirely in Q signals because of the language barrier.

Electronics in Japan is not as rosy a picture as you have been painting for the past several months in the pages of *73*.

I became well acquainted with a technical school teacher and ham during my tour there, 1960-1964. The Senior Class of 1962 had about 25 young men in the electronics courses and nearly all were hams. Only one of these 25 is working in electronics, and he is with the local telephone company, in the microwave section.

I was a judge in their science fair. I talked to nearly all of the young men at least once a week. A recent visit, however, finds one of the "highly qualified" technicians operating a nearly bankrupt franchise camera shop. Another highly qualified technician worked for the Voice of America for a few years and now operates a coffee shop where coffee is $2.00 a cup. Another is selling real estate. These smart guys of the 60s that were heavily into electronics are no longer in the field in 1984.

My occupation allows one to meet current Japanese technicians who are in the US on temporary duty. I have yet to meet any 1984 technician who is a ham. I have yet to meet any who are graduates of a technical high school similar to the one I was acquainted with in the 60s.

I think what the Japanese have is a public relations gambit. There are many imposters out there in JA-land. Perhaps you have been taken in, Wayne.

As for Japanese research and development, they are not doing it. I have corresponded at great length about developing robotics (electronics), some in breakthrough areas, but there are no takers in JA-land, with the excuse similar to that in USA—no development money. That is, I have been willing to give away the basic ideas and provide testing and other resources free, but *still* no takers.

As for amateur radio in Japan, I have the September issue of *CQ Ham Radio*, all 537 pages of it. It is almost entirely advertising. There is less than 100 pages of ARRL-type station news. Technical stuff is pretty slim, maybe 12 pages. Is that a good deal for amateur radio? I think not.

This letter does, however, reflect my nature with regard to amateur radio; that is, I am arrogant, cynical, and skeptical.

Frank Jerome W5AT
Midwest City OK

CW ONLY

I am a Novice license holder and a subscriber to *73*. I enjoy reading it cover to cover and enjoy your editorials. In the December, 1984, issue, I believe you stated that the FCC has washed its hands of policing the ham bands. If this is so, please let me and the rest of the Novice license holders know who to turn to for help in cleaning up the 15- and 40-meter Novice bands that are supposed to be used for CW only.

On Wednesday, November 11, 1984, I was sending CQ on 21.146 MHz when I was drowned out at 7:20 am by ZF2BD in contact with KA9KDS using voice. This is the middle of the Novice (CW only) band. I don't have a *Callbook*, so I don't know where they are located. Before they signed off, they made plans to make contact again on 40 meters at 7.125 MHz.

It seems to me that these two amateur CB operators have much more of the amateur bands to use voice on than the Novices have for CW. I, for one, would like to see the Novice or CW bands used for CW only, as this is the way they were intended to be used.

I hope this letter will help to clean up the misuse of the Novice or CW bands and remind the higher class license holders to use the bands properly.

J. R. Russell KA0FCM
Lockwood MO

Alas, one can't be sure who is wearing the CB shoes these days! In the case of your QRM from ZF2BD on voice, if you will check the international ham frequency allocations, you'll find that this chap had every right to be using voice on that frequency—Cayman Islands are not part of the US, so they don't have to use American subbands. If KA9KDS was also on voice on the channel—well, that's not legal. But I'll bet KDS was safely up in the American phone band, working cross-frequency to the ZF2.—Wayne.

CONCEDE OR DESTRUCT

Regarding Wayne Green's last two editorials in the November and December issues of *73*, I would like to present these sentiments on behalf of all the concerned amateurs standing just outside the circle of fury and frenzy generated by the code/no-code confrontation relative to amateur-radio licensing. It's bad enough that they must accept the inevitability of losing certain frequencies to the future demands of commercial requirements, but there is also the matter of pride that was once so great, now being demeaned by the influences and the attitudes inside and outside their ranks. Influences and attitudes that run the gamut of human frailty from apathy to willfulness.

Despite allegations to the contrary, there are thousands of amateurs who still want it remembered that their hobby is more than "a small group of aging men..." or "entertainment for a few technical nuts...", that their pursuit is an avocation that accommodates the communicator and the experimenter, gives hope to the disabled and the confined, serves the public in times of special events and local disasters, plays an important and vital part in the defensive posture and economic structure of our nation and could, if a nuclear holocaust engulfed the world, provide the only link to a sane survival through the innovativeness and creativeness of the experienced amateur.

And they believe that, with firm, constructive ledership, the winds of "fury and frenzy" can be calmed, the bickering of "tired old men" can be quieted, the aid of the general public can be enlisted to help increase interest in amateur radio, and finally, the attitude of the FCC might even be changed. But none of this can be accomplished unless all concerned amateurs recongnize that the cure for our ills is not to compound the blame with more denigration, but only through a renewed spirit of cooperation and compromise.

And I would plead with every individual concerned with the protection of our beloved fraternity, whether or not he concedes that his operating habits make him suspect for indictment, that he rationalize his feelings, measure his sensibilities, and concede that we are in deep trouble.

We have discussed the extent of amateur radio being over and above a simple hobby. What about enhancing the name and the image to Amateur Radio Services?

We have discussed firm and constructive leadership. If we can't have a separate Commissioner of Amateur Radio Services, what about campaigning for Senator Barry Goldwater as a future member of the FCC upon retirement from the Senate?

We have discussed public help in increasing interest in amateur radio. Have the Boy Scouts of America been queried on the possibility of establishing super merit badges earned by the acquisition of various grades of amateur licenses as extensions of their present merit badge obtained for learning the Morse code?

Have colleges been queried on the idea of establishing scholarships for technical merit based on a degree of excellence acquired through a combination of amateur-radio experiences, grade of license, and value of public service?

Last, but not least, I am not completely convinced that no-code licensing would increase interest in amateur radio, especially on 220 MHz. And I am just as concerned that there are other factors besides no-code licensing that encourage amateur-radio participation in Japan. Therefore, I propose a change in amateur-radio operating regulations that I believe would greatly stimulate interest in amateur radio. It would certainly open the door. In fact, its potential for national service beyond helping amateur radio is only limited by its degree of expansion. And take note "tired old men...", we could be talking about the security, welfare, and future of our grandkids.

In essence, the proposal would permit certain qualified amateurs and certain Special Privileged licensees to communicate solely with each other on prescribed frequencies; all units owned, maintained, and controlled by the qualified amateur would be operated under his direct or indirect supervision and responsibility in accordance with FCC regulations. The Special Privilege License would require passing an examination on FCC regulations and some knob-twisting questions on the level of those taken in auto driving tests.

Revolutionary as this concept may be, I would not be surprised that for every negative response we might find ten positives by the objective thinkers. Let's see what

the readers say. Here is some food for thought:

1) No additional QRM.

2) Every household with a qualified amateur could automatically extend the blanket of family security and welfare. Amateur ingenuity and application would be a manufacturer's delight.

3) Immediately interest in amateur radio would be increased. Properly supported and publicized, it could be like honey to the fly.

4) Operating procedures are dictated by the FCC. Amateur radio sorely needs more operating ethics. Women participants could provide more of that in proportion to the degree that we encourage their participation. And let's admit it, technical exams are also a roadblock to the mother and the housewife. Why not whet her appetite and see what happens after that. How come just answering a few simple questions gets a driver's license to drive a lethal machine instead of questions on automotive engineering or first aid?

5) Boy Scout leaders in their patrols and high school teachers in their radio clubs could greatly stimulate participation in communications through actual example.

6) For the antenna experimenter, a field strength meter, a Privileged assistant, and an HT would be paradise.

7) For the FEMA, a giant step towards ultimate national emergency communications. Possibly some sort of a tie-in with police facilities could eventually be developed through scanners, etc.

Well, that's it and if it's heresy, then let it be. Much water has passed over the dam since the days of my first spark coil. The fascination and excitement of those pioneer days are gone. But for us "tired old men...", the nostalgia still remains. Shouldn't each new generation have the same right to this same opportunity, too?

Wherever there is controversy and turmoil, there must be a cause. For those who will look beyond the horizon of this cause, they will find the hope of cooperation and compromise. For the skeptic there is only the bottom line, Concede Or Destruct.

Larry Amann K5TQN
Holiday FL

COAX CONNECTIONS

I thoroughly enjoyed Fred Cook's article, "The End of the Line," in your November, 1984, issue. Proper PL-259 coaxial connector installation is something that most amateurs, I believe, have misunderstood. Having installed and repaired literally hundreds of mobile telephones, two-way radios, and repeaters has really helped me appreciate this science.

Here are some additional suggestions that I find helpful and hopefully will aid those who find this task still a bit difficult.

- Unless you use silver-plated connectors, soldering to the four shield holes can be quite difficult. Scraping the inside of these holes with a small knife or reamer roughens the plating for better solder adhesion.
- It is advisable to screw at least 3/8" of the barrel over the outer insulation, providing superior mechanical strength.
- I would suggest checking the connector for shorts before *and* after soldering the connector.
- When soldering the shield, I lay solder over the hole and place an already heated 550-Watt soldering gun tip to the top of the solder. The solder flux runs into the hole, cleaning things up, and the hot gun quickly heats the materials. Usually a 550-Watt gun will heat the connection in about a second. The quicker you can heat the connection and remove the gun, the less chance you have to melt the center insulation. It is amazing how many "professionally installed" connectors I have replaced that have melted insulation due to too much heat from soldering the shield.
- Bravo to the layered Scotch brand tape and Scotchkote! There are no finer connector-weatherizing materials. Do *not* use cheap tape. It is miserable climbing a 100-foot tower in a Michigan snowstorm to repair a wet coaxial connector.

Please continue publishing these invaluable "basic" articles. They are always needed.

Dean A. Alger WD8ONL
Grandville MI

I HATE CODE

First, let me say that I am not even a ham yet. I went to take the test (Novice) from a VEC at the Chattanooga Hamfest and didn't pass it because of the code. But I do know enough about electronics to be at least General class. I took it in high school and got all A's.

The reason I didn't pass the code test is I hate code. It is awkward and stupid to use. Now, don't get me wrong—I am not just crying because I didn't pass, but I know that code is not more reliable than voice or digital.

I am now a CBer. I know that hams look down on CBers as being uncivilized and ignorant with the use of the bands, but have you listened to some of the ham bands lately?

Two meters around here seems like CB because of the way some of the hams hog the band. But that is like anything else—there are good and bad hams and CBers.

When I failed the test, by the way, a ham friend of mine told me that most amateurs don't want any more hams because of the QRM it would create on the bands. I can see that point, but what happens when all of the old hams die? Trouble, huh!

Since I have been in CB (about 11 years) I have almost always obeyed every rule (I still use my call letters because I like to), but I have seen a drop in CBers in the last few years.

Since the FCC dropped the license on CB, there has been a drop in popularity because anyone can do it now. The CBers I know all use linears, overmodulate, and use unallotted channels to keep any interest in the hobby. (I don't do those things.) I think a hobby should be fun and challenging, not a pain in the rear like the code.

If the FCC drops the code, in my opinion, it will go like CB. A lot of people would lose interest in it and leave it for the dedicated ones—like the CBers who are left (the illegal ones).

I will take the test again and again until I pass it. I just hope that there is a hobby for me to get into by the time I pass the code test.

Keep up the good work—you run a great mag. I read it all the way through every month.

Thanks for all of your dedication. I hope to talk to you sometime maybe on 20 meters, if you aren't dead of old age by the time I get my General.

Rick C. Wilson
Chattanooga TN

✓ See List of Advertisers on page 80

BARTER 'N' BUY

Individual (noncommercial) .... 25¢ per word
Commercial .... 60¢ per word

Prepayment by check or money order is required with your ad. No discounts or commissions are available. Please make your payment to *73*. Rates for multiple insertions are available on request.

Advertising must pertain to amateur radio products or services. No special layouts or positions are possible. All advertising copy must be submitted typewritten (double-spaced) and must include full name and address. Copy limited to 100 words, maximum. Count only words in text. Address, free.

73 cannot verify advertising claims and cannot be held responsible for claims made by the advertiser. Liability will be limited to making any necessary corrections in the next available issue.

Copy must be received in Peterborough by the 5th of the second month preceding the cover date.

Send to Barter 'N' Buy, c/o Nancy Ciampa, Advertising Department, *73*, Elm Street, Peterborough NH 03458.

MILITARY TECHNICAL MANUALS for old and obsolete equipment. 60-page catalog, $3.00. Military Technical Manual Service, 2266 Senasac Ave., Long Beach CA 90815. BNB045

REPAIR, alignment, calibration. Collins written estimates, $25; non-Collins, $50. K1MAN, (207)-495-2215. BNB117

IMRA—International Mission Radio Association helps missionaries by supplying equipment and running a net for them daily except Sunday, 14.280 MHz, 1900-2000 GMT. Br. Bernard Frey, 1 Pryer Manor Rd., Larchmont NY 10538. BNB123

NEW HAM-SWL SOCIETY for unity of thought & learning. Open to all. Many topics, awards, free ad space in periodical, society net, museum participation. Shack pics & QSLs welcome. Writers needed. SASE for info to RCSW, 32 Applegate, Bennington VT 05201. BNB197

CHESS PLAYERS—Radio-chess schedules, matches, tournaments. Details. K2VJ, Box 882, Cologne NJ 08213. BNB207

CX7 REPAIRS. Mark Mandelkern, 2315 Derby St., Berkeley CA 94705; (415)-549-9210. BNB213

SCHEMATICS: Radio receivers 1920s/60s. Send name, brand, model no., SASE. Scaramella, PO Box 1, Woonsocket RI 02895-0001. BNB214

HAM RADIO REPAIR, tube through solid state. Robert Hall Electronics, PO Box 8363, San Francisco CA 94128; (408)-729-8200. BNB219

HAM TRADER YELLOW SHEETS, in our 23rd year. Buy, swap, sell ham-radio gear. Published twice a month. Ads quickly circulate—no long wait for results. SASE for sample copy. $9 for one year (24 issues). POB 356, Wheaton IL 60189. BNB220

DX HEADING MAPS for Boston, NYC, Phila., Baltimore, Detroit, Atlanta, Chicago, New Orleans, Saint Louis, Dallas, LA. 11 x 17 $1.75 pp. 22 x 34 $5.95 pp. Specify city. Bill Massey W2HOJ, PO Box 397, Hainesport NJ 08036. BNB221

QSLS on wood grain, glossy, and brightly-colored card stocks. Samples 40¢, QOF Press, Dept. 2, 505 S. Barstow #212, Eau Claire WI 54701. BNB250

QSLS to order. Variety of styles, colors, card stock. W4BPD QSLs, PO Drawer DX, Cordova SC 29039. BNB260

THE DX'ERS MAGAZINE. Up-to-date, informative, interesting. Compiled and edited by Gus Browning W4BPD, DXCC Honor Roll Certificate #4. Send for *free* sample and subscription information today. PO Drawer DX, Cordova SC 29039. BNB261

COCO OWNERS—Free software and hardware brochure. CoCoNuts, POB 9866, San Jose CA 95157-0866. BNB265

COMPREHENSIVE RTTY, ASCII, CW software package for TRS-80 models I/III/4. Free brochure. KCQ Software, 6319 Boeuf Trace, Alexandria LA 71301. BNB270

CASH PAID for traffic/speed radar equipment. Write or call: Brian R. Esterman, PO Box 8141, Northfield IL 60093; (312)-251-8901. BNB271

SCIENCE SOFTWARE for the Commodore 64 and VIC-20. Amateur satellites, moonbounce, radio astronomy, and more. For a disk or tape with five sample programs, send $5.00 to David Eagle, 7952 W. Quarto Dr., Littleton CO 80123; (303)-972-4020. BNB272

REPEATER VOTER: Four-channel expandable signal-to-noise voter card. The voter selects the best signal from the audio. Just give it COR and audio and it returns the best signal. All multiple-receiver repeaters should have one. Commercial design. For more information write: Voter, Hall Electronics, 815 E. Hudson St., Columbus OH 43211. BNB274

KENWOOD 430S owners only! Stop Scan—when the squelch breaks, the scan stops! Adjustable resume scan delay. No modifications! Kit $25, assembled $35. JABCO, R1 Box 386, Alexandria IN 46001. BNB275

WHY SELL IT? You can donate that unwanted equipment, get the tax break, and feel like a million. Contact the kids learning English via amateur radio at Junior High 22 on Manhattan's Lower East Side. WB2JKJ, Junior High School 22 ARC, 111 Columbia Street, New York, NY 10002. BNB276

COPY SATELLITE PHOTOGRAPHS, weather maps, and press on our military-surplus facsimile recorders. Recorders are solid-state, dual-speed, and fully automatic. Catalog available. Atlantic Sales, 3730

BE MY GUEST

Guest Editorial by Perry Donham KW1O

STOP PLAYING AROUND

I had a really nice chat with Sanpio XZ5A the other day. It went something like this: "R TU 5NN NH 73." And now I have some new pasteboard on the wall of the shack.

Even as I was sending the exchange, I felt a flush of anger and resentment. I resented the fact that there was no way on Earth I could have a casual conversation with this fellow, and I was angry at myself for playing the DX game. Playing so hard, in fact, that I felt it would be a cardinal sin to ask Sanpio any question at all regarding the shack, or the weather, or any pets he might have. You know the feeling. And even if I could have overcome the guilt of establishing a conversation, I can't imagine a few hundred greedy DXers standing by on frequency while we chatted. That's not playing the game.

What is the force behind DXing? What drives otherwise normal hams to screaming obscenities and using "a little extra" power? Something is very wrong with amateur radio if all we can say of ourselves is, "Oh, I've worked 304 countries" when asked what we do with our hobby. It's time that we stop destroying ham radio and take a close look at the image we project to the world outside.

Here's the key: Let's do away with DXing. Let's get rid of all the silly pins and certificates and Honor Roll listings. I can see some really positive things coming out of such a plan.

First, there would be a drastic reduction in the amount of stations on the air at any given time, with an attendant increase in the rate of information exchange. This is because we would with one blow eliminate thousands of hams who can't carry a conversation beyond the "5NN NH QSL SURE" stage. These people would just wander back to the TV and switch on "Family Feud."

Second, an enormous quantity of rare DX would appear on the bands, since they wouldn't be hounded off the air by 3-kW stations demanding to be acknowledged. They would be shy and elusive at first, remembering past hurts, but soon they would realize that the true communicators left really were interested in their lives. As it is now, these fellows get so disgusted with the continual pileups that they just leave the air and take up philately. But what they *really* want is someone to talk to.

Finally, we would do away with all the bickering and hatred involved in hard-core DXing. I think sometimes we forget that amateur radio is more than a hobby—it's a *service*, unlike photography or riding horseback. Working DX is just one tiny part of the hobby, but it seems to be a breeding ground for greed and ill will.

Here are three steps that we can take right now. We've got to do *something*, or we might as well all pitch our rigs into the dumpster:

- Eliminate the DXCC Honor Roll. The basic DXCC award should be retained—it's still an accomplishment to work 100 countries. And we'll maintain some sort of shrine for those who've already received their HR stickers.
- Require the QSL cards for any DX award to document that a conversation of not less than ten minutes took place. The "5NN NH" folks will just have to send r-e-a-l slow.
- Create a special category of awards specifically for the contest-style DXer in which the contacts can *only* be made during a contest or DXpedition.

Some of these suggestions may be impractical, but I think you can get the point. We simply must inject a little more idle chit-chat into ham radio.

Ham-Day '85

Now that your circulation is going, I want to remind you about Ham-Day '85. H-Day is March 24th, and it's the day that every ham in the United States is going to invite one person into his or her shack for a live demonstration of amateur radio. H-Day is a very simple way to get a whole passel of people interested in our hobby. The idea is *not* to teach your guest(s) radio theory or (heaven forbid!) Morse code, but just to give them a little taste of the fun that can be had on the bands. You could even let them take the mike for a while. A *really* sneaky thing to do would be to find out (secretly, of course) some part of the country where your guest has friends or family, then set up a schedule to that location!

The thing to remember is this: We hams have a whopping good time, and it shows. All you have to do is get someone into your shack for one hour, make a few contacts, and BINGO—a seed is planted. Don't worry if the person doesn't immediately sign up for a Novice class. Someday, maybe ten years from now, they will think back on that time spent in your shack and the seed will start to grow. Don't you remember how *you* became interested?

Perry Donham KW1O is 73's Technical/International Editor.

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

from page 4

itors. Give 'em a taste of what it's like.

Clubs—please make a club project out of this. Organize visitors to club-member ham shacks or even set up demonstration stations in malls, but set them up so the visitors will be able to talk over the stations and others around will be able to hear what is going on.

March 24th is D-Day—ham Demonstration Day. Let's get every ham we can on every band to demonstrate amateur radio and to talk with visitors to ham shacks.

CES

The Winter Consumer Electronics Show in Las Vegas drew nearly 100,000 attendees again—mostly hi-fi and electronics dealers from all over the country. And again virtually all of the products were from Asia. The new and exciting products, almost without exception, were from Japan. The biggest hits of the show were the new compact discs and players. They were the fad of this season—just as low-end computers were the fad a year ago, video games the year before, and hand-held electronic games the year before.

Someone asked me why there were virtually no Ameri-

can-made products at the show. I explained that Japan has left our country in the dust in electronics. They're graduating more engineers than we are and their best and brightest are going into creating new consumer electronics products. Engineers we've developed in the US—and the number hasn't grown in over twenty years despite the incredible growth in electronics—are going into military electronics, where the unlimited money is. Japan has no military projects, so their top people are working on consumer electronics.

So I wandered around the show looking over the latest stuff from Hitachi, Mitsubishi, Panasonic, Toshiba, Casio, Seiko, Epson, NEC, Sansui, Nakamichi, Kyocera, Quasar, JVC, Sony, and so on. The good old American brands such as RCA and GE were Japanese-made, too.

The way to change this, if it isn't already too late, is to get kids interested in hamming so they'll be attracted to high-tech careers later on. In that way we'll eventually have some engineers, technicians, and scientists. You can bet that there isn't a single kid in Japan who isn't familiar with amateur radio. Every high school has a ham club—many with hundreds of members. Perhaps we can get started with D-Day—ham Demonstration Day—and begin to get the word out.

We have about 100,000 hams in America who are reasonably active—who have stations which might help demonstrate our hobby. If every active ham were to show just five friends and neighbors how amateur radio works, we'd have a half million Americans acquainted with our hobby. That's a start.

Japan, with over a half million active hams and nearly 1.4 million licenses issued, will still be way ahead of us—and with only half our population! But if this idea works, perhaps we can gear up and do this two or three times a year and gradually get the word around. It sure would be nice if every American had an understanding of our hobby and realized that he/she could join in the fun if he/she wanted.

For those hams who haven't read the rules, there are certain restrictions against visitors talking over your station. A friend can talk to hams in any country that the US has a third-party agreement with.

I'll be on twenty looking to talk with your visitors on D-Day, so look for me.

Writing about CES, my main reason for getting to the show involved my new *Digital Audio* magazine—about the compact discs. I've managed again to be in the right place at the right time with a new magazine—just as I was with *Byte* when the microcomputer revolution got started. Our address is WGE Center, Peterborough NH 03458.

Digital Audio is particular fun for me because I've been a hi-fi hobbyist for almost as long as I've been into hamming. And back in the early 50s, when LPs and hi-fi really got started, I was a major manufacturer of speaker enclosures. Larry LeKashman, who'd been an editor of *CQ* before me, was the driving force at Electro-Voice. The electronics industry was smaller then, with radio and audio as its main components.

But in addition to the excitement of compact discs for listening—and by the way, once you hear one you'll have a terrible time not buying a player—their potential for computer applications is awesome. One 4-3/4" disc can hold around 600 megabytes of data. That's about 300,000 pages. Indeed, about twenty of these discs could hold the name, address, and phone number of every person in the world with a phone.

What few hams we have left in our hobby seemed to be at CES and many of them stopped by the *Digital Audio* booth to say hello. My thanks!

Okay, so where do compact discs fit into amateur radio? It's really too early to tell yet, but one good possibility might be to combine sound and pictures on a disc and thus be able to have everything needed to teach our license classes on a single disc. Several firms are already mixing pictures with sound and/or data on these laser discs.

A world *Callbook* on disc would be duck soup, making it possible for us to search for anyone by name, call, location, and possibly other parameters such as special interests like satellite communications, packet radio, repeaters, RTTY, and so on. An index to every ham article ever published along with reprints of everything published in the last few years might take a couple discs.

DAYTON

Since amateur radio has gone from bad to worse in the last year—as I predicted, unfortunately—I'd decided it might be best if I skipped haranguing everyone at Dayton again this year. The role of being the bearer of bad news isn't my forte. I much prefer to be upbeat. If I do have bad news, I at least want to have some good positive suggestions for solving the problems. But I honestly don't see any real salvation for our hobby—unless this D-Day concept takes hold and we start getting newcomers interested. So, lacking any positive ideas, I decided that the need for another nagging session wasn't there, so I should skip my yearly talk.

Jack Burnett suggested that, well, if I didn't want to talk about amateur radio, perhaps I would just talk about what Wayne Green is doing these days. I don't know why that would be of interest, but I'm game—so I agreed. I'll bring some slides so you can see the new WGE headquarters, the Green Publishing Institute, the new magazines I've started, and so on. No one will come, I know.

After being one of the more unknown people in the world—at least outside of amateur radio—I've been enjoying the recent publicity I've gotten. The February issue of *Folio*, the publishing magazine, had a nice article on me. And the February issue of *Venture* likewise. *Venture* is a great magazine, by the way, and I'd say that even if they didn't do a Wayne Green article. There are some more in the works and who knows, all this PR may eventually convince one of the consumer magazines to do a bit on me.

So, get your station cranked up for D-Day—and look for me at Dayton, okay?

SPECIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine *by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices,* 73 Magazine, *Pine St., Peterborough NH 03458.*

MILWAUKEE WI
MAR 2

The Milwaukee School of Engineering ARC will sponsor its second annual swapfest on Saturday, March 2, 1985, beginning at 8:00 am, at the MSOE cafeteria, downtown Milwaukee. Admission is $2.00 and tables are $3.00. Setup is at 7:30 am. Food will be available. Talk-in on 146.19/.79 (W9HHX). For tickets or more information, send an 8½ x 11 SASE to MSOE ARC W9HHX, 1025 N. Milwaukee Street, Room C-6, Milwaukee WI 53201, or call Pete or Paul at (414)-347-1099.

CIRCLEVILLE OH
MAR 3

The Teays Amateur Radio Club will hold its seventh annual hamfest on March 3, 1985, beginning at 8:00 am, at the K. C. Lodge, two miles north of Circleville OH on County Road #51 (old #23). Sellers' setup begins at 6:00 am. Tables (8-foot) are $4.00 in advance and $5.00 at the door. Tickets are $2.00 in advance and $3.00 at the door. Talk-in on the Circleville repeater (147.18). Refreshments will be available. For table reservations, send an SASE to Joe Subich AD8I, 7825 State Route #188, Circleville OH 43113. For additional information, contact Len Campbell WB8PPH, 8951 State Route #188, Circleville OH 43113.

SPRINGFIELD MA
MAR 3

The Mount Tom Amateur Repeater Association, Inc. (MTARA) will host its first annual indoor flea market on March 3, 1985, from 9:00 am to 4:00 pm, at the Knights of Columbus Hall, Elder Council 69, Granby Road, Chicopee MA (easy access from I-90, I-91, and I-391). Admission is $1.00; tables are $7.00 in advance and $8.00 at the door. Power is available for vendors. Setup begins at 8:00 am. There will be food available. For table reservations or more information, contact Mickey Yale N1CDR, 6 Laurel Terrace, Westfield MA 01085; (413)-562-1027.

ST. LOUIS MO
MAR 8

The Jefferson Barracks Amateur Radio Club will hold its 25th annual Amateur Radio Auction on Friday, March 8, 1985, beginning at 7:30 pm, at the St. Louis Firefighters Hall, 5856 Gravois at Christy, South St. Louis City.

MORRIS PLAINS NJ
MAR 8

The Split Rock Amateur Radio Association will hold its annual ham auction on March 8, 1985, beginning at 8:00 pm (doors open at 7:00 pm), at VFW Post 3401, Tabor Road (Route 53), Morris Plains NJ. Free parking will be available. For more information, write to SARA, PO Box 3, Whippany NJ 07981, or check the K2RF repeater on 146.385/.985.

HUDSONVILLE MI
MAR 9

The Holland Amateur Radio Club will sponsor its second annual Amateur Radio Auction on Saturday, March 9, 1985, from 9:00 am to 1:00 pm, at the Hudsonville High School auditorium, 5051 32nd Ave., Hudsonville MI (6 miles north of I-196, Exit 62). Equipment can be checked in from 8:00 am to noon. A 10% donation will be received from each item sold. Talk-in on 146.06 and .52. For more information, contact Dan Ruiter KC8KN, 7106 Michael Drive, Hudsonville MI 49426.

LAFAYETTE LA
MAR 9-10

The Acadiana Amateur Radio Association will hold its 25th annual hamfest on March 9-10, 1985, in conjunction with the American Radio Relay League Louisiana State Convention, at the Holiday Inn Central Holidome, just south of Interstate 10 on Highway 167, Lafayette LA. For further information, contact the Acadiana Amateur Radio Association, PO Box 51174, Lafayette LA 70505.

INDIANAPOLIS IN
MAR 10

The Morgan County Repeater Association will sponsor the Indiana Hamfest (formerly the Martinsville Hamfest) on March 10, 1985, starting at 8:00 am, at the Indiana State Fairgrounds Pavilion Building, Indianapolis IN. Admission is $5.00. A premium table is $40.00, a flea-market table is $8.00, and a flea-market space without a table is $3.00. All tables must be reserved in advance. Setup for reserved tables will be available Saturday, March 9, from 3:00 pm to 9:00 pm. Setup on Sunday, March 10, is from 6:00 am to 8:00 am. No cars will be let inside after 8:00 on Sunday. There is free parking. Talk-in on 145.25. For table reservations or information, send an SASE before March 1 to Aileen Scales KC9YA, 3142 Market Place, Bloomington IN 47401; (812)-339-4446.

STERLING IL
MAR 10

The Sterling-Rock Falls Amateur Radio Society will hold its Silver Anniversary Hamfest on March 10, 1985, beginning at 7:30 am, at the Sterling High School Fieldhouse, 1608 4th Avenue, Sterling IL. Admission is $2.00 in advance and $3.00 at the door. There will be commercial distributors, dealers, and a large flea market. There will be free parking and space to accommodate self-contained campers overnight. Food will be available. Commercial tables and tables requiring electricity are $5.00; other tables are $3.00. Talk-in on 146.25/.85 (W9MEP). For tickets, table reservations, or information, contact Sue Peters KA9GNR, PO Box 521, Sterling IL 61081; (815)-625-9262.

✓ See List of Advertisers on page 80

BLACKSBURG VA
MAR 14–16

Virginia Polytechnic Institute and State University will hold a workshop, Personal Computer and STD Computer Interfacing for Scientific Instrument Automation, on March 14–16, 1985, at Virginia Tech, Blacksburg VA. The hands-on workshop, directed by Mr. David E. Larsen and Dr. Paul E. Field, is $450.00 for three days. Participants will be wiring and testing interfaces. For more information, write Dr. Linda Leffel, CEC, Virginia Tech, Blacksburg VA 24061, or phone (703)-961-4848.

NORTH AMERICAN OPEN SLED DOG RACE
MAR 15–17

During March, 1985, contacts with the Arctic Amateur Radio Club will be confirmed with special QSL cards picturing Fairbanks' three major winter events: the Yukon Quest sled dog race, the Winter Ice Festival, and the North American Open sled dog race. The AARC will also mount a 48-hour contest-style operation during the North American Open, from 0000 UTC on March 15 through 0000 UTC on March 17, on 80 meters through 70 cm, using the club callsign KL7KC. To qualify for an award certificate, submit a QSL from KL7KC dated March 15, 16, or 17, 1985, and cards from any two members of the AARC dated March, 1985 (or a list of contacts certified by an official radio club or two other amateurs). Endorsements for working 25 additional AARC members during March are available. Please send $5.00 (to cover the cost of certificate printing and handling) to: Arctic Amateur Radio Club, PO Box 81389, Fairbanks AK 99708.

HUDSON NH
MAR 18

The Interstate Repeater Society will hold its annual flea market on Saturday, March 16, 1985, at the Lions Club, Lions Avenue, Hudson NH. Talk-in on 146.25/.85 and 146.52 simplex. For complete information or to reserve a table, write the Interstate Repeater Society, PO Box 693, Derry NH 03038, or call Dick WB8YGR at (603)-889-3479.

FT. WALTON BEACH FL
MAR 18–17

The Playground Amateur Radio Club (PARC) will sponsor the fifteenth annual North Florida Swapfest on Saturday, March 16, 1985, from 8:00 am to 4:00 pm, and Sunday, March 17, 1985, from 8:00 am to 3:00 pm, at the Ft. Walton Beach Fairgrounds, Ft. Walton Beach FL. For further information, contact the Playground Amateur Radio Club, PO Box 3075, Ft. Walton Beach FL 32548.

MIDLAND TX
MAR 18–17

The Midland Amateur Radio Club will hold its annual St. Patrick's Swapfest on Saturday and Sunday, March 16–17, 1985, at the Midland County Exhibit Building, located east of Midland on the north side of Highway 80. The hours on Saturday are 10:00 am to 5:00 pm and on Sunday, 8:00 am to 2:30 pm. Registration is $5.00 in advance and $6.00 at the door. Tables are $6.00 each. Volunteer examiner tests for all categories will be given and refreshments will be available. For reservations and further information, please contact the Midland Amateur Radio Club, PO Box 4401, Midland TX 79704.

WEST HARTFORD CT
MAR 17

The Insurance City Repeater Club will hold its third annual ham-radio/electronics flea market on March 17, 1985, from 9:00 am to 4:00 pm, at the American School for the Deaf, North Main Street, West Hartford CT. Admission is $1.00 and tables are $8.00. For more information, contact Charles I. Motes, Jr. K1DFS, Treasurer, 22 Woodside Lane, Plainville CT 06062; (203)-747-6377.

CONEMAUGH VALLEY PA
MAR 17

The Conemaugh Valley Amateur Radio Club will hold its eighth annual hamfest on Sunday, March 17, 1985, from 8:00 am to 4:00 pm, at the East Taylor Fire Hall, on Route 271, five miles south of Route 22 (4 miles north of Johnstown PA). Food will be available. Talk-in on 146.34/.94. For more information, write to the Conemaugh Valley Amateur Radio Club, 2829 Bedford Street, Johnstown PA 15904.

TRENTON NJ
MAR 17

The Delaware Valley Radio Association will hold its 13th annual flea market of amateur-radio and computer equipment on March 17, 1985, from 8:00 am to 4:00 pm, at the New Jersey National Guard 112th Field Artillery Armory, Eggerts Crossing Road, Lawrence Township, Trenton NJ. Admission is $2.50 in advance and $3.00 at the door. There will be indoor and outdoor flea-market areas, commercial dealers, and plenty of refreshments. Sellers must provide their own tables. Talk-in on 146.52 and 146.07/.67. For advance tickets and space reservations, send an SASE to KB2ZY, Box 441B, RD #1, Stockton NJ 08559.

JEFFERSON WI
MAR 17

The Tri-County Amateur Radio Club will hold its annual hamfest on March 17, 1985, from 8:00 am to 3:00 pm, at the Jefferson County Fairgrounds, Jefferson WI. Tickets are $2.50 in advance and $3.00 at the door. Tables are $3.00 in advance and $4.00 at the door. There will be plenty of food and free parking. Doors open at 7:00 am for sellers only. Talk-in on 144.89/145.49, 146.22/146.82, 146.52/.52. For more information, advance tickets, or table reservation, send an SASE to Bob Barker K9RIJ, 724 Burdick, Milton WI 53563.

MAUMEE OH
MAR 17

The Toledo Mobile Radio Association, Inc., will hold its 30th annual Ham/Computer Fest and Auction on Sunday, March 17, 1985, from 8:00 am to 5:00 pm, at the Lucas County Recreation Center, Key Street, Maumee OH. Admission is $2.50 in advance and $3.00 at the door. Tables will be available. Alternate activities will be held in the 4-H room, starting at 11:00 am. Free parking and refreshments will be available. Talk-in on 146.52, 147.87/.27, and 447.850/442.850. For tickets or more information, contact Joseph Nyitray W8LNV, 3950 Drummond Road, Toledo OH 43613; (419)-472-7935.

CHINESE WATER GOD
MAR 23–24

The Yuba-Sutter ARC will operate WA6AGD from 1600 UTC on March 23 to 0400 UTC on March 24 to commemorate the 105th annual parade and festival in honor of BOK KAI, the Chinese Water God. WA6AGD will be using the low end of the General phone bands of 75, 40, and 20 meters and also 147.450 simplex. For a certificate suitable for framing, send a QSL and an SASE to WA6AGD, c/o BOK KAI, Marysville CA 95901.

H-DAY
MAR 24

Sunday, March 24, 1985, is H-Day: *73*'s attempt to help attract more people into amateur radio. We want YOU to PERSONALLY invite someone to watch you operate. Share ham radio for only one hour with ANYONE who you think might be interested. Stop worrying about ham radio's future—do something about it. ARS W2NSD/1 will be on the air most of the day and KW1O will have dragged some unsuspecting passer-by into the shack. Help us help you—on H-Day.

GROSSE POINTE MI
MAR 24

The Southeastern Michigan ARA (SEMARA) will sponsor its annual Swap and Shop on March 24, 1985, from 8:00 am to 3:00 pm, at Grosse Pointe North High School, 707 Vernier Rd., Grosse Pointe MI. Admission is $3.00 and tables are $8.00. Talk-in on 147.150 repeater and 146.52. To reserve tables, call George Berg KB8SS at (313)-446-1804, or write to PO Box 646, St. Clair Shores MI 48080.

LYNN MA
MAR 24

THE 19/79 ARA of Chelsea MA will hold its annual flea market on Sunday, March 24, 1985, from 11:00 am to 3:00 pm, at the Ireson building in Ryan Hall (part of the Lynn Hospital complex), 493 Western Avenue (Route 107), Lynn MA. Admission is $1.00 and tables are $6.00 in advance and $8.00 at the door. Talk-in on 146.19/.79 and 146.52. For table reservations, send checks to 17/79, PO Box 171, Chelsea MA 02150.

WINCHESTER IN
MAR 24

The Randolf Amateur Radio Association will hold its 6th hamfest on Sunday, March 24, 1985, from 8:00 am to 5:00 pm, in the Winchester National Guard Armory. Ticket donations are $3.00 and children under 12 will be admitted free. Table space (by reservation only) is $5.00 with a table and $2.50 without. On Saturday, setup is from 6:00 pm to 8:00 pm and on Sunday, 6:00 am to 8:00 am. Features will include dealers, a flea market, programs, food, and drinks (all inside). Talk-in on 147.90/.30 and 224.90/223.30. For reservations and more information, contact RARA, Box 162, Winchester IN 47394, or call Herb James WB9UZZ at (317)-584-4995.

FARGO ND
MAR 30

The Red River Valley and NDSU Amateur Radio Clubs will sponsor a ham-radio/computer show and swapmeet on March 30, 1985, from 8:00 am to 5:00 pm, at the Army National Guard Armory at Hector Field. Commercial tables are $20.00 and noncommercial tables are $5.00 ($3.00 for a half table). Talk-in on 146.16/.76. For table reservations or more information, contact Tim Gooding WD0GUR, Event Chairman, 1008 Sheyenne Street, West Fargo ND 58078; (701)-282-6630.

WELLESLEY HILLS MA
MAR 30

The Wellesley Amateur Radio Society will hold its annual spring auction on Saturday, March 30, 1985, beginning at 11:00 am, at the Wellesley Hills First Congregational Church, 207 Washington Street, Wellesley Hills MA (on Route 16 at the intersection of Route 9). There is no admission charge. Check-in will start at 10:00 am. Commission is 15%, with a $1.00 minimum and a $30.00 maximum. There will be free parking and food available. Talk-in on 147.63/.03. For more information, contact Nels Anderson K1UR at (617)-872-5259.

UPPER SADDLE RIVER NJ
MAR 30

The Chestnut Ridge Radio Club will hold a ham-radio flea market on March 30, 1985, at the Saddle River Reformed Church Education Building, East Saddle River Road and Weiss Road, Upper Saddle River NJ. There is no admission fee. Tables are $10.00 for the first one and $5.00 for each additional table. There is a $5.00 fee for tailgating. Food will be available. For more information, call Jack Meagher W2EHD at (201)-768-8360 or Roger Soderman KW2U at (201)-666-2430.

EGG HARBOR CITY NJ
MAR 30

The Shore Points Amateur Radio Club, Inc., will sponsor Springfest 85 on Saturday, March 30, 1985, from 9:00 am to 2:00 pm, at the Atlantic County 4-H Center, Egg Harbor City NJ (about 15 miles west of Atlantic City). There will be 8000 square feet of heated indoor space; covered tailgating will be available, weather permitting. Admission is $5.00 for sellers (bring your own table) and $3.00 for general admission ($2.50 in advance). There is a limited amount of ac in the indoor space. For more information, contact SPARC, Box 142, Absecon NJ 08201.

COLUMBUS GA
MAR 30–31

The Columbus, Georgia, ARC will sponsor a hamfest on Saturday, March 30, 1985, from 9:00 am to 5:00 pm, and Sunday, March 31, 1985, from 9:00 am to 3:30 pm, at the Columbus Municipal Auditorium, Columbus GA. There will be ARES and MARS forums, an open-air flea market, free coffee, and free parking for self-contained RVs (no hookups). Indoor tables are $6.50 per day. Tickets are $1.00 each, 6 for $5.00, and 13 for $10.00. Talk in on 146.01/.61. FCC exams will be given on Saturday morning. For more information, contact George M. Reitz N4AGO, RR2, Box 22D, Seale AL 36875; (205)-855-2204.

DIXON IL
MAR 31

The 19th annual Rock River ARC Hamfest will be held on Sunday, March 31, 1985, beginning at 8:00 am, at the Lee County 4-H Center, one mile east of the junction of Routes 52 and 30. Tickets are $2.00 in advance and $3.00 at the door. 8-foot tables are $5.00 and inside space for the flea market is $3.00. There will be food available. Talk-in on 146.37/.97 and 444.700/449.700. For advance tickets (available until March 15) or further information, contact Shirley Webb KA9HGZ, 618 Orchard Street, Dixon IL 61021; (815)-284-3811.

TIMONIUM MD
MAR 31

The Baltimore Amateur Radio Club, Inc., will hold the ARRL-approved 1985 Greater Baltimore Hamboree and Computerfest

on Sunday, March 31, 1985, from 8:00 am to 4:00 pm, at the Maryland State Fairgrounds Exhibition Complex, east of I-83, Exit 17, just north of Baltimore, in Timonium MD. Admission is $4.00 and children under 12 will be admitted free. There will be a special commercial exhibitors' and dealers' area, a giant indoor flea market, a large hard-surface tailgating area, an ARRL forum, FCC license exams, and guest speakers. Talk-in on 146.07/.67 and 146.52 simplex. For additional information, contact GBH&C, PO Box 95, Timonium MD 21093-0095, or phone (301)-561-1282.

MADISON OH
MAR 31

The Lake County Amateur Radio Association will hold its seventh annual Lake County Hamfest and Computer Fest on Sunday, March 31, 1985, from 8:00 am to 4:00 pm, at Madison High School, Madison OH (40 miles east of Cleveland). Admission is $3.00 in advance and $3.50 at the door. A 6-foot table is $5.00 and an 8-foot table is $6.50. Setup begins at 5:30 am. All display space is indoors and there will be plenty of free parking. Talk-in on 147.81/.21. For information or reservations, send an SASE to Lake County Hamfest Committee, 713 W. Jackson, Painesville OH 44077; (216)-953-9784.

GRAYSLAKE IL
MAR 31

The Libertyville and Mundelein Amateur Radio Society (LAMARS) will host LAMARSfest 1985 on March 31, 1985, beginning at 8:00 am, at the Lake County Fairgrounds, Grayslake IL. Setup begins at 6:00 am. Admission is $2.00 in advance and $3.00 at the door. There will be a large indoor electronics and radio swapfest, commercial exhibits, code-speed efficiency testing, food, and free parking. Talk-in on 146.94 and 147.63/.03. For more information or for reservations, contact LAMARS, PO Box 751, Libertyville IL 60048; (312)-255-8717.

WOOD COUNTY WV
APR 14

The second annual NWWVRA Hamfest will be held on April 14, 1985, from 8:00 am to 4:00 pm, at the Wood County 4-H Grounds. There will be an all-indoor flea market and dealers are welcome. Admission is $3.00 and flea-market spaces are $3.00 each. There will be food and XYL activities. Talk-in on 147.360/.960. For further information, send an SASE to Jim Whitlatch, 5007 Elmwood Avenue, Parkersburg WV 26101, or call (304)-422-7157.

BEDFORD PA
APR 14

The Bedford PA, Altoona PA, Somerset PA, and Cumberland MD Amateur Radio Clubs and the Blue Knob Repeater Association will sponsor the third annual Southern Alleghenies Hamfest on Sunday, April 14, 1985, from 7:00 am to 4:00 pm, at the Bedford County Fairgrounds, one mile west of Bedford on Route 30 and one half mile west of the Route 220 Bypass (close to the Bedford Exit of the PA Turnpike). Admission is $3.00, tables are $5.00, and outside tailgate spaces are $2.00. Dealers can set up the day before. Talk-in on 145.49/.89, 444.2 +5 MHz, and 146.52. For more information, contact Joel Cunard KB3TR, RD 6, Box 104, Bedford PA 15522; (814)-623-9697.

FRAMINGHAM MA
APR 14

The Framingham Amateur Radio Association, Inc., will hold its annual spring flea market on April 14, 1985, beginning at 10:00 am, at the Framingham Civic League Building, 214 Concord Street (Route 126), Framingham MA. Sellers can set up at 8:30 am. Admission is $2.00 and tables are $10.00 (which includes one free admission) and preregistration is required. Food will be available. Talk-in on .75/.15. For more information, contact Joe Weiner K1VVC, 52 Overlook Drive, Framingham MA 01701; (617)-877-7166.

ROCHESTER MN
APR 20

The Rochester Amateur Radio Club, Inc., will sponsor the eighth annual Rochester Area Hamfest on Saturday, April 20, 1985, starting at 8:30 am. Tables are $8.00 each. Setup is on Friday, April 19, from 4:30 pm to 6:30 pm. For more information, contact the Rochester Amateur Radio Club, 2253 Nordic Ct. NW, Rochester MN 55901; (507)-288-7688.

SOMERSWORTH NH
APR 20

The Great Bay Radio Association will sponsor the Springfest 85 flea market/hamfest on Saturday, April 20, 1985, from 9:00 am to 3:00 pm, at the Somersworth Armory, Blackwater Road, Somersworth NH. Admission is $1.00 and tables are $8.00 (includes one admission). There will be food and free parking. Talk-in on 146.40/147.00. For table reservations or more information, write to Great Bay Radio Association, PO Box 911, Dover NH 03820.

GRAND JUNCTION CO
APR 20

The Grand Mesa Repeater Society will hold the sixth annual Western Slope Amateur Radio and Computer Swapfest on Saturday, April 20, 1985, from 10:00 am to 4:00 pm, at a location to be disclosed later, in Grand Junction CO. Admission is free and tables are $5.00 each. Features include an indoor swapfest, exams, an auction, and refreshments. Talk-in on 146.82 and 449.200. For further information or to reserve a table, send an SASE to Larry Brooks W0ECV, 3185 Bunting Avenue, Grand Junction CO 81504; (303)-434-5603.

FITCHBURG MA
APR 27

The Montachusett Amateur Radio Association will hold a flea market on Saturday, April 27, 1985, from 9:00 am to 3:00 pm, at the Knights of Columbus Hall, Electric Avenue, Fitchburg MA. Admission is $1.00 and tables are $8.00 each. Sellers can set up at 8:00 am. Talk-in on 144.85/145.45 and 146.52. For table reservations or more information (make check payable to M.A.R.A.), contact Jim Beauregard, 7 Mountain Avenue, Fitchburg MA 01424.

SULLIVAN IL
MAY 5

The Moultrie Amateur Radio Klub (MARK) will hold a hamfest on Sunday, May 5, 1985, from 8:00 am to 3:00 pm, at the Moultrie County 4-H Fairgrounds, five miles east of Sullivan IL. There will be a heated indoor and large covered outdoor flea market. There is no charge to vendors, and space is available on a first-come, first-served basis. Vendors can set up on Saturday, May 4, but there are no overnight hookups. Talk-in on .655/.055 and .52. For more information, write MARK, PO Box 79, Sullivan IL 61951, or call Vernon Jack K9SWY at (217)-728-7596.

150TH ANNIVERSARY SPECIAL EVENT
VICTORIA, AUSTRALIA

A special commemorative callsign, VI3WI, part of the 150th anniversary celebration of the European settlement in Victoria, will be on the DX bands until at least April 30, 1985. VI3WI will be activated on a roster basis by selected members of the Wireless Institute of Australia and its affiliated clubs. All DX bands and all modes will be used and a commemorative QSL is available, either direct or via the VK3 QSL Bureau. A special award certificate is also available for radio contact with Victoria between November, 1984, and April 30, 1985. Contact (SWLs log) one station in VK3 during the award period to qualify. A QSL card for the qualifying contact, endorsed with a congratulatory message on Victoria's 150th anniversary, plus $2.00 or equivalent, should be sent to Victoria 150 Award, Wireless Institute of Australia, 412 Brunswick Street, Fitzroy 3065, Victoria, Australia.

✓ See List of Advertisers on page 80

REVIEW

THE MICRO HTs

It used to be said that bigger was better, but in this day of "state-of-the-art" electronics, smaller is better. Well, if that's really the case, then the new Kenwood TH-21A two-meter HT (hand-held) must be the best.

History

It was only a few short years ago, in the early 70s, that the typical ham using an HT on 2-meter FM was found holding a radio with one- or two-channel capability, an 18-inch pullout antenna, and a weight of better than two pounds. I always referred to these HTs as "bricks." The size and weight was about the same as a brick.

With the advent of phase-locked loop (PLL) and central processor unit (CPU) usage in the typical HT of today, the operator is no longer "rock-bound" to only a few repeater or simplex frequencies.

The current crop of 2-meter HTs is hot with feature-loaded units, having hundreds of possible frequency pairs, memory and scanning capabilities, and some even tell the time. However, as with everything, they all have drawbacks. All require considerable dexterity to completely utilize their many features, and all are a real handful in the size and weight department. The typical weight exceeds one pound and is even more if a large-capacity battery is installed. But these units are state of the art, feature-wise.

How about something that is state of the art, size-wise? How about something that is small and simple to operate?

The Kenwood TH-21As

Apparently, I'm not the only one to think that a smaller, simpler-to-operate HT would be nice. The folks at Kenwood thought so and kindly introduced the TH-21A (TH-21AT with DTMF keypad).

The new TH-21A is so small that my first impression left me wondering if it was a child's toy, or if someone from the *USS Enterprise* had left their communicator behind. It's really size impressive.

The little unit readily fits into a shirt or jacket pocket yet is so light that it will not pull your clothing askew. The size is comparable to a pack of 120mm cigarettes, and the weight is about 10 ounces.

SPECIFICATIONS FOR THE TH-21A AND TH-21AT

General	
Frequency range	144 MHz to 148 MHz
Signal type	F3
Antenna impedance	50 Ohms
Power requirements	
Voltage	5.8 to 10.0 V dc (nominal 7.2 V dc)
Consumption	standby—less than 28 mA XMIT (high)—600 mA (low)—300 mA
Dimensions	width 2-1/4 inches height 4-3/4 inches depth 1-1/8 inches
Weight	9.8 ounces (with antenna and battery)
Transmitter	
Output power	(high) 1.0 W (low) 150 mW
Modulation system	reactance
Max. deviation	±5 kHz
Receiver	
I-fs	first 16.3 MHz second 455 kHz
Sensitivity	S/N more than 28 dB at .5 microvolts 12 dB SINAD at .25 microvolts
Selectivity	−6 dB at more than 12 kHz −40 dB at less than 28 kHz
Af output	more than 250 mW

Operation

I found that the TH-21A was quite simple to operate and displayed no bad habits.

All controls, except repeater offset (−600/simplex/+600) and power selection (hi/low), are on the top of the case. Although small, I found none to be cumbersome to operate.

The available audio is more than enough for comfortable listening—actually considerably more than my full-featured monster—and is very intelligible. Frequency selection is made by use of thumbwheels.

The battery slides onto the back of the TH-21A for use and is removed for recharging. It is not possible to recharge the battery while it is on the radio.

In actual use I was very skeptical of the small battery. It only has a 180-milliampere-hour rating. Yet I worked the radio all evening, on several repeaters, and did not kill the battery. However, in all fairness, I must admit to using low power on the closer machines.

During my QSOs, I asked of course about the quality of my audio and apparent signal strength (am I full quieting into the repeater?). I made no mention of the fact I was testing a new rig until after signal reports were exchanged. No negative comments about the audio were heard; in fact all reports were good to excellent. Regarding power, on the close-in repeaters I was full quieting on low power. For the others I needed high power.

In making an autopatch I didn't have to hold the PTT switch after pushing the first number. The rig stays keyed for 1-1/2 seconds after the last digit is depressed. This is not unique but is a handy feature.

I made a few quick measurements to check the specifications:

- rf output power
  (hi): 1.5 W
  (low): 250 mW
- receiver sensitivity
  open squelch at: .05 microvolts
  12 dB SINAD at: .15 microvolts
- transmitter frequency
  found to be 95 cycles high
- deviation
  +5 kHz to −5 kHz

The measurements were made by use of Wavetech, Cushman, and Bird instruments.

Remarks

Operationally I have to give high grades to the new TH-21A. It is everything I would expect of a good HT. For handiness I'd have to rave on and on. The diminutive size and bantam weight of this micro HT are its strongest points. It is approximately one half the size and weight of my trusty ICOM 2A, yet has the same features and similar specifications.

I can make only two negative comments. First, the operator must remember that the battery life is rather limited. Installing a larger battery would only negate the size value of this radio. I recommend the purchase of an extra battery. Second, the antenna should have been made in the "short duck" style. This would be better for shirt-pocket operation. I'm sure the after-market people will take care of this shortcoming in a hurry.

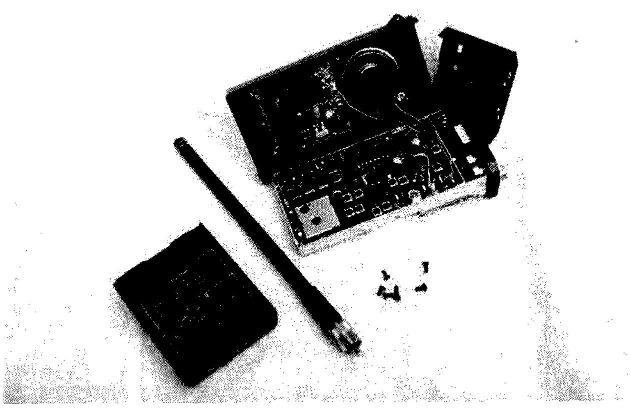
Accessories Available

- PB-21 rechargeable nicad battery pack
- BT-2 battery pack for AAA alkaline batteries
- EB-2 external battery pack for on the belt
- DC-21 dc-to-dc power supply for mobile operation
- SMC-30 speaker/mike
- HMC-1 headset with VOX
- SC-8 carrying case
- AJ-3 antenna-to-BNC adapter
- TU-6 tone unit

For additional information, contact *Trio-Kenwood Communications, 1111 West Walnut Street, Compton CA 90220.* Reader Service number 488.

Bill Clarke WA4BLC
Falls Church VA

The largest thing about the TH-21AT is the antenna.



With its cover off, the TH-21A reveals a well laid out transceiver. On the left is the slide-on battery.

VIC MSO—A MODERN MAILBOX

I have always loved getting mail! From as early as I can remember I have carefully tracked my postal carriers, knowing just what time I can expect them to deliver mail to my address.

Amateur radio seems to have strengthened my obsession with the mail. Even as a teenager I was always waiting for an envelope from the QSL bureau, or the latest issue of *73*.

Now I've been thrown a curve. Oh, I can still count on my regular mail to be there when I expect it, but somebody came up with "electronic mail." It comes whenever it feels like it!

An outgrowth of the computer revolution has been the implementation of message-storage operations, or MSOs for short. The first ones required a lot of dedicated hardware. Now it's possible to have your own MSO that will run on a VIC-20. The computer must be expanded by at least 8K of memory. The Commodore 64 will work equally well.

Mark Mumaw NU6X of Vid-Com Communications, 3131 Foothill Blvd., #H, La Crescenta, California 91214, has written VIC MSO. It's a very powerful program for Commodore computer owners interested in having their own MSO.

In operation, VIC MSO lies in waiting,

continually looking for its "turn-on" code. Something like MSOKA9XYZ is usually used. Once activated, it responds with a log-on message and awaits instructions.

Most MSOs operate in a similar fashion, and VIC MSO emulates its big brothers and sisters. A simple ".HELP" command will return the full set of user commands, so even the first-time user can navigate around the system.

The list of commands is fairly extensive, too. You can read, write, and delete messages. The DIR option returns a directory of everything in the system, or an SDIR followed by a keyword like your callsign scans the directory for any messages containing the keyword you are looking for.

VIC MSO is very versatile. It will speak and listen in 60-, 75-, and 100-wpm Baudot (Teletype®) code or at 110-baud ASCII. The mode is selectable by the user.

A system-operator (that's you) mode allows local control of the program without actually going on the air. Additionally, VIC MSO can be used for regular RTTY and ASCII work in the direct mode. There are few features in the direct mode, but it's handy if you want to do a little real-time communicating without crashing the MSO program.

Besides the program, you will need a VIC-20 or C-64 computer, a terminal unit, and a cord to connect from the computer to the TU. Full instructions are included on how to do this.

Kantronics interface owners can for an additional fee purchase a cable "ready to fly." The cost is $5.00. VIC MSO communicates through the user port (RS-232 port) on the computer, so the regular cord supplied with Kantronics and AEA software that connects to the joystick port will not work.

The design on VIC MSO allows even amateurs without a disk drive to participate in MSO operation. The program itself is available on disk or tape and will run without a disk drive.

Disk drive owners will find that storage capability is increased since messages are stored and retrieved from disk when it is available.

The timekeeper program in VIC MSO keeps track of the time, time zone, and date and logs them on each operation. Part of the same routine will deactivate the MSO in the absence of input after several minutes.

From a programming standpoint, VIC MSO is broken into three major segments. A loader program calls the other two programs, so the second and third parts are invisible to the user.

A machine-language program is used to help speed the operations of VIC MSO, and a Basic language main program rounds out the picture.

My criticisms of VIC MSO are few, and some of them were being addressed before I even mentioned them. Currently, no provision is made for text editing. Mark indicates that improvement is "under construction."

Due to the copy-protection scheme employed, modifications to the program, such as the MSO activation code, are not intended to be user changeable. A simple addition to the program could leave the copy protection intact and still allow a user-selectable activation code.

Finally, I'm a bit nervous about the delete command. Any user can delete any message. I'd like to see the program allow for some protection, at least on system-operator-generated messages.

Now when I get up and go to work in the morning, my electronic mailbox works all day for me, ready to receive correspondence on a moment's notice. Now I have two mailboxes to check. That's great until I start receiving junk mail electronically!

VIC MSO is available from Vid-Com for $59.95 plus $1.90 postage and handling. Owners requiring the Kantronics interface cord should include an additional $8.95. For those in a hurry, the telephone number is (818)-957-7550.

For more information, contact *Vid-Com Communications, 3131 Foothill Blvd., #H, La Crescenta CA 91214.* Reader Service number 486.

Jim Grubbs K9EI
Springfield IL

THE HIDDEN SIGNALS ON SATELLITE TV

Everyone by now is familiar with the enormous quantity of television signals available from geosynchronous satellites. Across America, home satellite dishes are springing up in backyards, all pointing skyward to glean the ripe harvest of information being beamed to earth. The range of programming runs from 24-hour news to rock-music videos to educational and religious features. But few know of the "secret" side of the satellites, the ever-present non-video information broadcasts.

The Hidden Signals on Satellite TV is about this less frequently understood function of the satellite service. Written by Thomas Harrington and Bob "Coop" Cooper, the book is a complete guide to non-video satellite transmissions. Both authors bring their specialized knowledge to the effort, and their names have become well known in TVRO circles. Tom Harrington, a member of the Board of Directors of SPACE, has worked in the TVRO field for many years, dealing almost exclusively with satellite data transmission and reception. Bob Cooper is probably best known as the Publisher and Editor of the very popular *Coop's Satellite Digest* and *CSD/2.* Bob has 22 satellite antennas at his test range in the Turks and Caicos Islands, where he also provides commercial television service to the island residents.

Hidden Signals is divided into eight major sections, covering every type of non-video signal that is available on the satellites. The book begins with a concise explanation of satellite transmission formats and techniques. The following chapters explore audio subcarriers and where to find them, telephone systems, narrowband FM and digital services, satellite networking, various teletext formats, and news services. Handy appendices include a complete list of satellites and their transponders and a table giving each satellite's name and position. In addition, Chapter 1 provides an exhaustive look at each satellite transponder (there are hundreds!) and details what you might expect to hear on each one.

One of the things I liked best about this book is the clarity of its presentation. Bob and Tom don't assume that you know everything about satellite systems, and each important concept is given the careful explanation that so many references of this type lack. Vivid illustrations drive each point home. And they've set *Hidden Signals* up in a way that allows the more knowledgeable reader to skip the basics and get on to the main course. One slight drawback is the lack of a complete index, but if you know generally what you are looking for, a quick scan of the table of contents will net the appropriate chapter.

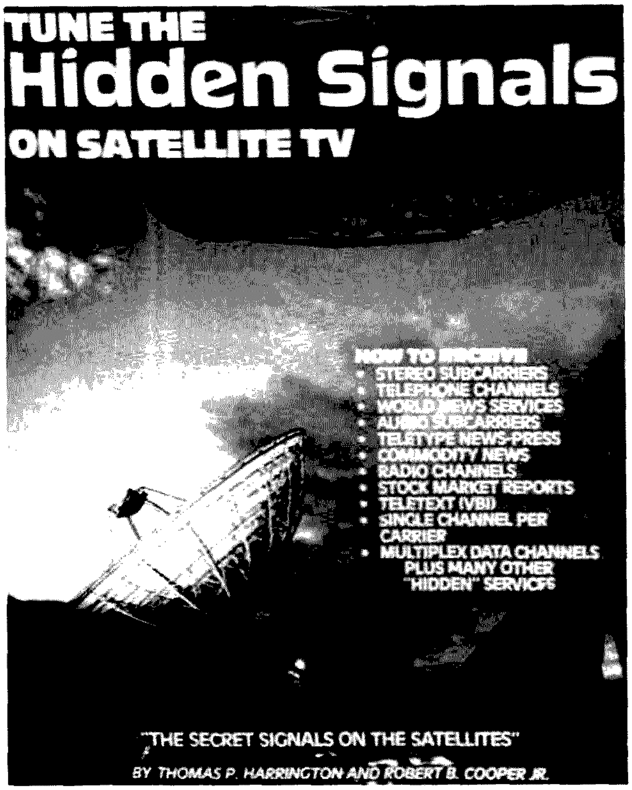
There is a great wealth of information

✓ See List of Advertisers on page 80

packed into this 180-page book. If you are a newcomer to TVRO, you'll find the first few chapters invaluable in helping you understand just what goes on 22,000 miles up in space. The more advanced hobbyist will welcome the challenge of new modes to receive. And, for the experimenter, Chapter 4 details a method of receiving data transmissions from the birds that costs under $100. And the book as a whole will find a place as a complete reference work on any TVRO enthusiast's shelf, a book that will be turned to again and again. *Hidden Signals* is priced at $14.95 plus $2.00 shipping and handling.

For more details about *The Hidden Signals on Satellite TV*, contact *Universal Electronics, Inc., 4555 Groves Road, Suite 3, Columbus OH 43232.* Reader Service number 485.

Perry Donham KW1O
73 Staff



The Hidden Signals on Satellite TV *from Universal Electronics.*

AEA'S MICROAMTOR PATCH™

I suppose the basic question is whether or not you can teach an old dog new tricks . . . and, believe it or not, Mike Lamb N7ML has proven that you can. Let me explain.

I grew up in amateur radio during the 1950s, when Teletype® meant clanking, heavy, noisy, and sometimes balky Model 15s or, if you were really lucky, a Model 19. Your shack sounded just like the newsroom of the *Daily Planet* . . . and your family, if any remained after the first operating session, lived with Mother.

Then, things became smaller and smaller, TUs became solid state, and Models 28ASK and 28FSK machines appeared. Still, none of this was for me; I was not into mechanical monstrosities at the time, nor am I today. If RTTY was ever to appear in my snack, the drawbacks would have to go. As a consequence, I missed all of the fun and charm of old-time RTTY and the weird, clackety-clack machines, the tape reperforators, and all of the reams of yellow, coarse paper piled up on the floor. Yes, and the oak rolltop desks and Collins 75A1s, too. Ah . . . those were the days! Still, I didn't bite and the RTTY mystique passed me by.

Too late, I thought, for an old dog like myself to update now—to learn a ham's lifetime of new lingo—and to get into the funny world of Baudot, 5-bit codes, and (ugh!) *typing*. I'd better explain. A good share of my life is spent typing: columns, newsletters, correspondence, and the like . . . but you must realize it's not "touch" typing. My version is two-fingered sight typing, and if I can't look at the keys, I don't know where I am or what I am doing. So, take that as a starting point and tell me how or, for that matter, *why* someone like me would even be interested in this new/old mode. Well, I'll save you the trouble: *curiosity*.

Frankly, I am just plain curious about what goes on in the world of auto diddle, chirp-chirp, and quick brown fox. But, as Churchill was supposed to have said, "Oh, how I love to learn, but how I hate to be taught!" I'm something like him in at least that one way—I didn't want to make the effort. Shame on me!

Now we get to the best part: Mike Lamb, President of Advanced Electronic Applications, changed all that by telling me that what I really needed, and what my life up until now was lacking, was the new MAP-64/2 MicroAMTOR Patch, a RTTY TU and interface that is plugged in between your Commodore 64 microcomputer and your station transceiver. That, the manual, plus the tiniest bit of reading was all I would need to become a new member of that fraternity of RTTY buffs.

Mike promised that it wouldn't hurt at all and that I might even *enjoy* it. "C'mon, Jim, you get the C-64, and I'll send the patch, okay?" Somewhat reluctantly I agreed, even then realizing that the two worn index fingers on my hands would be taking a double beating—pounding the C-64's keyboard and this typewriter for the review.

First things first: I had no microcomputer, so I went to the good folks next door at *RUN* magazine (a sister publication, devoted to the Commodore computers and their owners) and gently twisted the arms of Hal Stephens, the Advertising Sales Manager, and Guy Wright, the Editor, for the loan of a machine. I promised them anything and everything within my power, including bribery, and went home carrying a C-64 terminal and a matching color monitor. There, the AEA MicroAMTOR Patch (MAP-64/2) awaited me, having been delivered a few days before.

You might want to know that I am definitely computer-untutored—unfriendly, if you will—an analog man in a digital world, a fish out of water! Get the picture? Right! So it was with some amount of trepidation that my shaking fingers dug into the boxes as I wondered which piece of apparatus would byte (oh, no!) first.

Maybe you would like to know what you get for your money before you decide to plunk down $199.95 for this latest means of communicating with the world. Fair enough—let's have a peek at the MicroAMTOR Patch, find out what's inside, and see what it is supposed to do. This is going to be nontechnical, so relax.

Imagine a thin black box about the thickness of a paperback novel and just a little larger in width and length. On one side there is a protruding edge connector that fits into the expansion port on the right rear apron of the C-64. There is also a five-conductor cable that connects between the interface and the user port on the left rear apron of the C-64. The cable is all prepared with proper connectors on both ends. The MAP-64/2 does not come with a source of dc power (12 volts at 200 mA), so you will have to borrow some from the rig or from an ac adapter (which you probably have already). On the rear top of the box, in plain view, are three red LEDs and a green LED. The three red ones are to assist you in properly tuning Morse, RTTY, ASCII, and AMTOR signals, and the green one is to tell you when power has been applied to the patch—it lights up green for "go."

On the rear apron of the patch are some RCA-type jacks and 3.5mm speaker/audio jacks. These are labeled FSK, Key Line, Audio In, Audio Out, and 12 V dc. The lights are labeled, too—the left one is Mark and the right one is Space . . . and I forget what the center one is labeled, but when properly tuned to any of the signals capable of being decoded by the patch, it will be lit all the time . . . so I don't worry about it. Three push-button switches on the rear panel select CW, RTTY narrow (170 Hz), or RTTY wide (850 Hz). MicroAMTOR Patch is a software/hardware interface package that incorporates MBATEXT *and* AMTORTEXT software for the Commodore 64 computer. It uses active filters to provide the necessary filtering for 170-cycle and 800-cycle shifts for wide and narrow RTTY and for CW. The software is built into ROM, that is, IC chips which guide the transmit/receive operations and provide a full multimode capability.

A shielded interface cable is provided to carry AFSK and PTT signals to the transceiver. You have to provide the appropriate connectors, and the manual suggests using the microphone connector. However, the little Yaesu FT-757GX transceiver that I am using has AFSK input and PTT input on the back of the rig, using RCA-type connectors, so I didn't have to wire a microphone plug. The cable is fully shielded to reduce EMI problems.

Being one to try to "wing it" wherever possible, I uncharacteristically decided to read the manual first. I hope that this doesn't cause any of you hard-core types to lose respect for me. I'd suggest you read it, too, as there is a lot of good information that you'll need to know. The manual is in three parts: a description of the MAP-64/2 including wiring diagrams and pinout information, a complete set of hookup instructions (with checkout procedure), and a list of possible problems and their cures. In addition, there is a portion on AMTOR theory, with instructions on how to operate your computer/interface/transceiver in all of the possible modes: AMTOR, RTTY ASCII, and Morse. For those of you with transceivers capable of frequency-shift keying (FSK), there is an FSK output from the patch that will permit you to use this mode as well.

Now, let's talk about what you can *do* with this little gem. Being very familiar with CW, and not at all with RTTY, ASCII, or AMTOR, I decided to familiarize myself with the interface by using it to communicate on CW at first, perhaps to get courage to face the unknown . . . after all, it's easier to defeat fears a few at a time.

I connected things according to the book but couldn't get it to print alphanumerics to the screen. Checking the "Problems-Solutions" table, I found that the most likely problem area was the five-conductor cable that runs between the patch and the computer. The troubleshooting guide suggested that the plug was reversed (it was not), but it really pointed to the fact that I should peek into the socket to see what was happening, if anything. Aha! Somehow the pins had become misaligned with the hole, and the plug was not mating properly. A quick tweak with my fingers brought everything into line, and the plug was reinserted. Voila! We got good copy on the screen. Morse characters flowed smoothly from left to right just like the book said. You know something? I've always suspected that those high-speed guys were sending gibberish instead of real Morse, and I wanted to prove it. I tuned into a station that was going faster than I can copy—*lots* faster. The screen said the speed was 60 wpm, and by Jove, it printed out that Morse as pretty as can be! What's more, they were actually saying something . . . and I could read it just as nice as can be. True, they weren't saying anything bad about me (or anyone else for that matter—another unfounded suspicion laid to rest) and the stuff it printed was not gibberish. It was about as common as most of us receive at 20 per. Oh well . . .

Next, I tried sending Morse. The top left of the screen shows you what speed you are sending, and you can select any speed you want just by punching the right func-

WHAT DO YOU THINK?

Have you recently purchased a new product that has been reviewed in *73*? If you have, write and tell us what *you* think about it. *73* will publish your comments so you can share them with other hams, as part of our continuing effort to bring you the best in new product information and reviews. Send your thoughts to *Review Editor, 73 Magazine*, Peterborough NH 03458.

tion key on your computer. The default speed is 20 wpm, so I used that to start and called a CQ. You load the buffer first (if you wish) and when the message is all ready, press f3 and let it go. The transceiver springs to life, and all the meters read properly... just like some little guy inside there was doing all the work. It was the first time I had ever sent CW with my arms folded, leaning back in the chair. End of message and—PANIC! Bloomin' thing didn't shut off by itself... oops, quick—where's the book? Oh yes, here it is. Punch f1 to shut it down. Things went back to receive, and—wonder of wonders—here comes a station back to the CQ. We had a nice chat... and you know what he told me? He said, "You sound just like all that other machine-sent Morse—perfect copy, and absolutely nothing to complain about... but it doesn't sound like *you* Jim," (implying, of course, all my faults)! So far, so good; everything going according to plan.

Am I brave, I wondered? *Really* brave? Aw shucks, the inside guy said, c'mon, give RTTY a try. Back to MENU, select R, check to see that 60 baud shows in the upper left, and the *receive* section is lit up. Tuning across 80 meters, I found a nice strong signal and discovered the little RYRYRYRYRYRY figures marching across the screen followed by a CQ, CQ, CQ and a station identification, and ending with PSE K K K. Summoning up the courage and typing madly, I managed to get something into the QSO buffer before he signed, then I hit f3 and waited. Would he come back? After depressing f1 (listen), I heard nothing. Shucks, what have I done wrong? Then, magically, the screen sprang to life with my call: W1XU, W1XU, de... and it was as big a thrill, I tell you, as my first-ever QSO way back in 1950!

To tune in the RTTY signals, you make sure the switch on the rear panel is depressed in the 170-cycle position, and that the "wide" or "CW" switches are not depressed. This selects the proper Chebyshev filter for proper demodulation. Then, tune across the signal and watch the little red LEDs. When the center one is on steadily, the right-hand one (space) is blinking on and off, and the left one is blinking occasionally, you have it pretty well tuned and should see readable print. If not, you could try a couple of other things, such as selecting another speed (from a choice of 67-, 75-, 110-, and 132-baud rates). If undecided, you can ask your AMTOR Patch to "guess" what the received speed may be. Then select the one it guesses. I found through a lot of listening that there are a lot of stations sending at the 110-baud rate—electronic bulletin boards (MSO stations) for example.

Once or twice I checked the ASCII mode and found signals that were copyable. Other times, no matter what I did, I couldn't find any variation of filters and tuning that would produce readable copy. Then, by chance, I tried the "invert" mode; lo and behold, there were a couple of stations talking to each other and complaining that they couldn't get any contacts. Obviously, they were newcomers like myself, who may not have read the book! Or, maybe they wanted to carry on in secret, but I don't think so. *Read the book!*

Finally, I want to comment about AMTOR—the "new" mode that has been around for years, commercially. Frankly, *that* really shook me up, because there are so many things to learn: how to call up a station or answer a calling station, what keys to use for various commands and options, an edit feature, a chance to use up those 10 empty message buffers, and all kinds of unexpected goodies that take a while to learn and really understand. No, I've not learned them all yet, but before telling you about getting my own station on AMTOR, receive and transmit, I'd like to mention a funny thing that happened last summer. The shack windows were open, and the weather was hot and humid. My wife had been listening to the AMTOR chirp-chirp for a while and—since I wasn't in the shack at the time—asked *me* to turn off the station... which I did (well, I turned it down, anyway). A little while later, she asked me why I hadn't turned off the AMTOR. I replied a bit testily that I had, indeed, turned if off—to which she replied, "Well, you just go look!" So, I went and found a cricket just outside the shack window chirping in sympathy with the AMTOR signal which must have attracted him (or her?). I wonder what AMTOR says in cricketese?

There are two basic AMTOR modes: mode A (ARQ) and mode B (FEC). Mode A is the automatic-request mode which is used for most middle-distance QSOs and is the "handshake" mode whereby the stations' signals are interspersed with each other, and phase-locking takes place. The FEC mode is the forward-error-correcting mode. It is used for very short or very long distance QSOs, for calling CQ, for bulletin transmissions, and for net operation. This mode sends each letter or number twice and goes on without waiting to see if the material has been received correctly. This is much like ordinary transmission. FEC is not intended to provide error-free copy.

The status panel in the upper left of the screen always tells you what's going on: listening, standby, phasing, idling, transmitting, or receiving—by your own station or by a station you are listening to.

When you use AMTOR, you will be using your Selcal, a convention that has been adopted for operation in the AMTOR ARQ mode. A Selcal is a four-letter code block recognized by your station's software and by the other station's software. It contains four letters from your call and is made up as follows: W1XU becomes WWXU, N7ML becomes NNML, KA1GAV becomes KAGA, and KK2Y becomes KKKY. Actually, you could choose what you want, like CQCQ, but it is considered better form to use the Selcal made up from your own callsign. The Selcal permits phasing lock between stations and initiates the message-transmitting/receiving process.

At first, I was quite successful in transmitting and receiving AMTOR messages in the FEC mode and in receiving AMTOR in the ARQ mode. But I was having a very bad time trying to synch my ARQ transmissions with the other station's chirps. This should have been done automatically but was not.

After reading everything I could find on the subject and looking over all of the equipment (including making some simple checks), I concluded that the computer's clock was not keeping time accurately. Just to check, I compared UTC with on-board time after setting the time into the program and waiting about an hour. I found the difference almost 2:1! ARQ permits up to a .3% difference in computer clocks for proper phasing (about 0.2 seconds per minute), but this was ridiculous!

The only answer would be to obtain another C-64. Thanks again to Guy Wright, I got one quickly. Taking it back to the station and plugging it in set things right; the program clock could now be set and would hold reasonable time over a period of several hours (within a second or two) and certainly within the limits of tolerance permitted.

Well, how does it work? Or should I say, how *well* does it work? Only you can be the judge, of course, but for me it works mighty well indeed. My biggest delight was calling up NNML, leaving a message for Mike in the Auto AMTOR mode, and having his machine respond by acknowledging the message and then shutting down. One could easily visualize two AMTOR-equipped machines in the auto mode talking to each other without an operator present at either station! I think I read a fiction article like that a few years back, but it's now apparent that yesterday's fiction is today's fact.

For further reading, you might wish to check Mike Lamb's article about AMTOR in the November, 1983, issue of *CQ*. It is clear, concise, and helpful, as is the manual which comes with the interface.

AMTOR has been approved for amateur-radio use since January 27, 1983, yet there seem to be surprisingly few stations that I can hear at my location that are using this relatively new mode.

For sure, it's not as fast as RTTY under ideal conditions, but in spite of its seeming slowness, it appears to be immune to fading and interference, guaranteeing essentially error-free reception and transmission.

Occasionally, you will find word bursts that appear garbled, but you can soon see that they are made up of three-letter repeats where perhaps one, two, or all three characters of the previous group had not been received properly. The print would stop, a request for repeat was automatically transmitted, and the retransmitted characters completed the word, adding the letters onto those that had been properly received before.

Well, you can imagine what a thrill it was to get my first AMTOR QSO, Mark Hald K2KI (KIKI). I met Mark on RTTY (old-fashioned kind) and we talked about AMTOR. Mark mentioned that he, too, had problems at first in trying to figure out how to use AMTOR.

Most of the manuals and articles tell you all about what it is, what it does, and why you need it, but very few tell you exactly *how* to use it or what to expect. For instance: Did you know that both stations in mode A will be going all the time? That is, they will be chirping continuously as long as you are in contact with the other station in that mode? Sure, it's easy to see after the fact (and after you have been through the procedure once), but not beforehand. Here's another thing: Did you know that *both* stations have to insert the *same* Selcal into the program in order to work each other properly? No? Well, I didn't either, and I couldn't find it explained anywhere. Oh, yes... they explain the Selcal and they explain the reason for it, but they fail to tell you that if it's *your* Selcal that both stations use, then you are the "master" and the other is the "slave." If you use the other guy's Selcal, then he's the master and you're the slave... at least to start.

Now, where does it say that you can type information into the program while you are in the automatic chirping mode (mode A)? When the other station is accessed and types in your Selcal, and the two are synchronized, the information you have typed in will then be transmitted by you and received by the other.

It's all very easy *after you have done it once or twice*, but it's that first step that gets you every time. Maybe all of the manufacturers of interfaces should include a helpful ham with each package!

In any event, Mark led me by the hand through the first painful get-acquainted steps by patient suggestions and advice. After about ten minutes we were chirping away happily, with each station able to "break in" merely by using the + ? code.

I was quite amazed that I broke in once, managed to get my information across, and then Mark's station continued right where he had left off, without missing a beat.

The copy was nearly perfect; I say nearly because whatever errors were in it were input errors and not machine or program errors. The MicroAMTOR Patch worked flawlessly. Next, we try the *big time* on 20 meters!

You'll find that it is convenient at first to use mode B, which is not the chirp mode but instead a steady transmission of data, much like ordinary RTTY, except that the characters are sent and acknowledged in groups of three, each group being sent twice.

So, whether you use the Morse program, the standard RTTY program, AMTOR, or ASCII, AEA's interface will do it all for you: no strain, no pain.

Listen for me around 14.075 MHz some evening or on a weekend. I'll be happy to let you see for yourself what the AEA MicroAMTOR Patch can do.

For further details, contact *AEA, PO Box C-2160, Lynnwood WA 98036*. Reader Service number 487.

Jim Gray W1XU
73 Staff

HAM HELP

Help! I need a service manual for a Boonton sweep signal generator model 240-A. I will gladly pay copying and mailing costs.

Gordon Fuip W6FBH
4740 Scratch Pine Lane
Placerville CA 95667

I am in desperate need of a schematic (and any instructions) pertaining to an E. H. Scott Radio, 15-tube model L-322, vintage 1933/34. I will gladly bear any cost incurred.

J. Fred Belles
8563 Peebles Road
Pittsburgh PA 15237

I need a service manual for each of the following scanners: Electra Bearcat 210XL, Tennelec MCP-1 Memoryscan, Tennelec MS-2 Memoryscan.

I also would like info on using my TRS-80 Color Computer on RTTY.

Please advise me of any cost involved.

Peter J. St. Arnaud
PO Box 8066
Lowell MA 01853

I'm looking for a photocopy of the manual or circuit diagram for a CREI model 255 scope, a Sonar Monitor Receiver model FR-102, the W9TO tube-type keyer, and a Geloso model 4/102-V vfo which was made in Milano, Italy and uses a 6L6, a 6AU6, and a 6J5. I will reimburse copying costs or can photocopy and return the originals.

Robert Ross VE3LPJ
4 Meadowland Drive
Brampton, Ontario
Canada L6W 2R4

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

VIRGINIA QSO PARTY
Starts: 1800 UTC March 9
Ends: 0200 UTC March 11

The 1985 QSO Party is again sponsored by the Sterling Park Amateur Radio Club. The same station may be worked on each band, once on each mode. VA stations may contact in-state stations for QSO and multiplier credit. VA mobile stations must sign as mobile and may be worked in each new county they operate from for new QSO and multiplier credit, even if previously worked on the same band and mode in another county. Stations on county line borders count for only one QSO. QRP stations must run 5 Watts or less for their entire operating time.

EXCHANGE:

QSO number starting with 001 and QTH consisting of state, province, DX country, or VA county. VA stations note that the reference for valid counties is the *CQ* "Counties Award Record Book," which lists a total of 95 counties.

FREQUENCIES:

Phone—3930, 7230, 14285, 21375, 28575, and anywhere on the 160-meter band except the DX windows; CW—60 kHz up from the low end of each HF band, and anywhere in 160-meter band or Novice subbands.

SCORING:

Count one point per voice QSO, two points per non-voice QSO (RTTY, CW, SSTV). No crossmode QSOs. VA stations multiply total QSOs by the sum of states, Canadian provinces, DX countries, and VA counties worked. Others multiply QSOs by the number of VA counties worked.

AWARDS:

Engraved plaques to the top-scoring stations in the following categories: VA Single Operator (fixed location); VA CW Only; VA Mobile; Out of State (including DX); VA QRP. Certificates will be awarded to winners of each VA county, state, Canadian province, and DX country.

ENTRIES:

Follow ARRL standard contest guidelines for logs. Indicate each new multiplier as worked and include a summary sheet with your log. Indicate on summary sheet if you are operating mobile, QRP, or CW only. Entries must be mailed by April 1, 1965, and should be addressed to: Virginia QSO Party, c/o Barry Pybas KW4I, 313 W. Derby Ave., Sterling Park VA 22170.

WISCONSIN QSO PARTY
Starts: 1800 UTC March 10
Ends: 0100 UTC March 11

Use both CW and phone. Stations may be worked once per mode on each band. Mobiles may be worked again when changing counties. No repeater QSOs!

EXCHANGE:

RS(T) and state, province, or Wisconsin county.

FREQUENCIES:

Phone— 3890, 7290, 14290; CW—3550, 3725, 7050, 7125, 14050, 21150.

SCORING:

Phone contacts count 1 QSO point while CW contacts count 2 QSO points. Wisconsin stations multiply QSO points by total number of states, provinces, and Wisconsin counties. DX countries count for QSO points but not multipliers. Non-Wisconsin stations multiply QSO points by number of Wisconsin counties (72 maximum). As a bonus, Wisconsin mobiles can add 500 bonus points for each county that they operate from outside of their home county, with a minimum of 15 QSOs per county to qualify.

AWARDS:

Awards will be presented to the highest scorers in each state and province. Wisconsin awards to 10 highest single-operator entries, plus the highest multi-single and multi-multi entries, the highest Novice/Technician, and the highest aggregate club score. Each club member's station must be located within 50 miles of the club (except for mobiles).

ENTRIES:

All entries must contain a log consisting of: time in UTC, call, RS(T), state, Wisconsin county, mode, and a score summary. Summary must include your name, address, and callsign. Circle new multipliers as worked. Logs containing more than 100 QSOs must be accompanied by a dupe sheet, with a separate dupe sheet for each mode. Mobile entries must indicate county changes in log and submit a separate dupe sheet for each county. Entries must be postmarked by April 15, 1985, and sent to: Wisconsin QSO Party, c/o West Allis Radio Amateur Club, PO Box 1072, Milwaukee WI 53201.

BERMUDA AMATEUR RADIO CONTEST
Starts: 0001 UTC March 16
Ends: 2400 UTC March 17

This is the contest's 27th year, and again it is sponsored by the Radio Society of Bermuda. The contest is open to all licensed amateurs in Canada, USA, United Kingdom, and the Federal Republic of Germany. Of the 48-hour contest period, your total operating time cannot exceed 36 hours, with off periods clearly logged. Each off period must not be less than three consecutive hours. All stations must be single-operator only and must be operating from their own private residence or property. Use all bands, 80 through 10 meters. No crossband or crossmode contacts are permitted.

EXCHANGE:

All stations will send RS(T) reports and give the following: Canadians add province, UK stations add county, US stations add state, West German stations add DOK#, and Bermuda stations add parish (see Fig. 1). US and Canadian stations may exchange reports with West German, UK, and Bermuda stations only. UK and West German stations may exchange reports with US, Canadian, and Bermuda stations only. Bermuda stations may work stations in the UK, US, West Germany, and Canada only.

SCORING:

Each completed contact, on each band, counts 5 points. A phone and a CW contact with the same station on the same band will count if they are made at least 30 minutes apart. For all stations outside Bermuda the multiplier is the total number of Bermuda stations worked on each band. For Bermuda stations the multiplier is the total number of states, provinces, countries, and DOK#s worked on each band. A multiplier may be counted only once per band.

AWARDS:

Printed awards to the top scorer in each state, province, country, and DOK area. The top scorer in Canada, US, UK, and West Germany shall receive a trophy, to be awarded at the Society's annual dinner held in October of each year. Round-trip air transportation plus accommodation will be provided to overseas winners to enable them to receive their awards.

ENTRIES:

Logs must show all dates and times in UTC. A separate sheet must be used for each band. All contestants must compute their own scores and check for duplicate contacts. Dupe sheets must be submitted with logs to cover each band where more than 200 contacts are logged. For every duplicate contact for which points are claimed, a penalty of three contacts will be deducted by the Contest Committee. An excess of claimed duplicates may result in disqualification. No penalty will be exacted against duplicates for which no

SAN—Sandys
PEM—Pembroke
SOU—Southampton
HAM—Hamilton
STG—St. George
DFV—Devonshire
WAR—Warwick
SMI—Smiths
PAG—Paget

Fig. 1. Bermuda parish abbreviations.

CALENDAR

Mar 2-3	ARRL DX Contest—Phone
Mar 9-11	Virginia QSO Party
Mar 10-11	Wisconsin QSO Party
Mar 16-17	YL-ISSB Commo System QSO Party—CW
Mar 16-17	Spring QRP CW Activity Weekend
Mar 16-17	Bermuda Amateur Radio Contest
Mar 16-17	DARC International SSTV Contest
Mar 16-17	Kentucky QSO Party
Mar 23-24	Tennessee QSO Party
Mar 30-31	Rio CW DX Party
Apr 20-21	World Fishing Contest—VIGO 85
Apr 20-21	QRP ARCI Spring SSB Contest
Apr 27-28	Helvetia Contest
Jun 8-9	Worldwide South America CW Contest
Jun 8-9	ARRL VHF QSO Party
Jun 22-23	ARRL Field Day
Jul 1	CARF Canada Day Contest
Jul 13-14	IARU Radiosport Championship
Jul 20-22	CQ VHF WPX Contest
Aug 3-4	ARRL UHF Contest
Aug 17-18	New Jersey QSO Party
Sep 14-15	ARRL VHF QSO Party
Sep 14-16	Washington QSO Party
Sep 26-29	Late Summer QRP CW Activity Weekend
Oct 5-6	ARRL QSO Party—CW
Oct 12-13	Rio CW DX Contest
Oct 12-13	ARRL QSO Party—Phone
Oct 19-20	ARRL Simulated Emergency Test
Nov 2-3	ARRL Sweepstakes—CW
Nov 16-17	ARRL Sweepstakes—Phone
Dec 7-8	ARRL 160-Meter Contest
Dec 14-15	ARRL 10-Meter Contest

NEWSLETTER OF THE MONTH

Congratulations this month to Editor Hal Gruber W8MGP of *The Mike and Key*, official publication of the Greater Cincinnati Amateur Radio Association (GCARA).

Hal puts together a very interesting newsletter filled not only with club news, but also with features such as hints and kinks, reports on current happenings in amateur radio, and operating tips. Like most successful club publications, *The Mike and Key* includes paid commercial advertising.

Club President Rick Burdick K8WWA and the entire GCARA membership have good reason to feel proud!

To enter your club's newsletter in *73*'s Newsletter of the Month Contest, send it to *73*, Pine Street, Peterborough NH 03458, Attn: Newsletter of the Month.

points are claimed. Each page must be clearly numbered and marked with contestant's call, year, and band to which it refers. All contestants must sign a statement that they have complied with the rules and terms of their license. All logs must be received by the Contest Committee, Radio Society of Bermuda, Box HM275, Hamilton, Bermuda, not later than May 31, 1985. Overseas contestants are recommended to forward their logs via air mail. All decisions of the Contest Committee are final.

YL-ISSB COMMO SYSTEM CW QSO PARTY

Starts: 0001 UTC March 16
Ends: 2359 UTC March 17

Use General portions on HF bands, simplex only on VHF bands, 160 meters through VHF. Individuals needing applications and instruction forms, send a 4 × 9 SASE to Rick and Minnie Connolly KØRDJ/NAØV, Star Route 1, Crocker MO 65452. Send logs, summary sheets, and comments to the same address no later than April 30, 1985.

G-QRP-CLUB SPRING CW ACTIVITY WEEKEND

Daily from 0900 to 2300 UTC March 16 and 17

All amateur-radio operators interested in QRP are invited to take part in the club's activity. No special exchange information was mentioned in the information provided by the club. The operating schedule for each day is as follows (times are UTC):

0900-1100 14060/21060/28060
1100-1300 3560/7030
1300-1400 10106
1400-1700 14060/21060/28060
1700-1900 3560/7030
1900-2100 14060
2100-2300 3560/7030

Reports should be sent to Fred Garratt G4HOM, 47 Tilshead Close, Druids Heath, Birmingham, B14 5LT, England.

DARC INTERNATIONAL SSTV CONTEST

Starts: 1200 UTC March 16
Ends: 1200 UTC March 17

Use all bands with authorized SSTV subbands. Entry classes include: Class I: shortwave bands; Class II: VHF and UHF bands; Class III: receiving stations. All transmitting categories are single-transmitter only. All contacts shall be worked from one location, and only one callsign shall be used during the contest. The same station can be worked just once per band.

EXCHANGE:

Exchange callsign, signal report, and serial QSO number on video. Only two-way video exchanges count. However, it is explicitly permitted to call CQ SSTV Contest on phone.

SCORING:

Class I and III stations count one point per contact on 80 and 10 meters. Class II and III stations count five points per contact on all VHF and UHF bands. Classes I and III count each contacted continent and each different country according to DXCC and WAE lists on each band for multiplier. Multiply QSO points from all bands operated by multipliers from all bands operated for final score.

For Class II stations, the multipliers are graded as follows: 2m times 2, 70 cm times 4, 23 cm times 6, and 13 cm and higher times 10. In this class, multiply QSO points from each band by its band-related multiplier and add up the results of all bands operated for final score.

AWARDS:

Trophy to top three scorers of each class. Printed certificates to top scorer of each country.

ENTRIES:

Entries must indicate date and time in UTC, callsign of station worked, complete exchange for each valid QSO, and name and address of entrant. Submit separate logs for each band. Multipliers must be clearly marked in the logs. Cross-check list and summary sheet are mandatory. All submitted papers become the property of the DARC. Disqualification for manipulation of results or excessive duplicate QSOs. Results will be published in *CQ-DL*, the DAR Club magazine. Contest logs must be postmarked by May 2, 1985, and addressed to: Heinz Moestl DE8BUS, PO Box 1123, D6473 Gedern 1, West Germany.

KENTUCKY QSO PARTY

2100 UTC March 16 to 0700 UTC March 17
1400 to 2200 UTC March 17

This is the third annual KY QSO Party sponsored by the Western Kentucky DX Association. Stations may work the same station on different bands, modes, or counties. Mobiles compete against mobiles, portables against portables, and fixed against fixed. Portable stations must set up per Field Day antenna rules. Single-transmitter entries only, and single operator for KY fixed stations. Single or multi-operators OK for portable or mobile stations.

EXCHANGE:

RS(T) and state, province, country, or KY county.

FREQUENCIES:

Phone—1840, 3985, 7285, 14285, 21385, 28585; Novice—3725, 7125, 21125, 28125; CW—1815 and approximately 60 kHz from the bottom of each band. KY stations must operate a minimum of 10 minutes for each change of band or mode.

SCORING:

Count 2 points for each 160-meter QSO, phone or CW, 2 points per CW QSO on all other bands, and 1 point per phone QSO on 80, 40, 20, 15, and 10 meters. Combine phone and CW score as one contest.

KY stations multiply QSO points by the sum of the number of states (50), KY counties (120), plus VO and VE1-7 and VY1/VE8 (9). DX stations count only in point totals, not as multipliers. Non-KY stations multiply QSO points by the total number of KY counties worked (120 maximum).

Portable and mobile KY stations add to total score a bonus of 1000 points for each county you operated in outside of your home county. A minimum of 10 contacts must be made in each county to qualify for the bonus.

AWARDS:

Plaques will be awarded to the highest-scoring KY fixed, KY CW and phone mobile, KY portable, and out-of-state station. First-place certificates will go to the highest-scoring Novice, Canadian, and DX station, as well as to the high scorer in each state. Participation certificates to all sta-

✓ See List of Advertisers on page 80

tions submitting logs with at least 10 contacts.

ENTRIES:

Logs should show date/time in UTC, station worked, band, mode, exchange, and score. Logs must be legible and neat to avoid disqualification. Submit a cross-check sheet (similar to ARRL form CD-77) for each band and mode with over 50 contacts. KY stations must show the counties they worked from as part of their log entry. Logs must be postmarked no later than May 5, 1985, to be eligible for award consideration. Send a large (9 × 12) SASE with $.40 postage to ensure receiving complete contest results plus any awards you may win. No logs will be returned. Entries should be addressed to: Western Kentucky DX Association, William D. Shipe WM4N, Route 1, Adairville KY 42202.

TENNESSEE QSO PARTY
2100 UTC March 23 to 0500 UTC March 24
1400 to 2200 UTC March 24

The fifteenth annual Tennessee QSO Party is sponsored by the Tennessee Council of Amateur Radio Clubs and directed by the Radio Amateurs Transmitting Society of Nashville.

EXCHANGE:

Tennessee stations give a signal report and county; out-of-state stations send a signal report and state, province, or country.

FREQUENCIES:

CW—1815 kHz and about 50 kHz from the bottom of the other HF CW bands; phone—1860, 3980, 7280, 14280, 21380, and 28580 kHz; Novice/Technician—3725, 7125, 21125, and 28125 kHz.

SCORING:

1.5 points per CW contact; 1 point for each phone contact. Combine phone and CW score, unless you wish to compete for phone only or CW-only awards. Out-of-state stations multiply QSO points by the total number of Tennessee counties worked. Tennessee stations multiply QSO points by the sum of the following: states (50), Tennessee counties (95), and VO and VE1-7 (7). DX stations count only for points—not as multipliers. For portable and mobile operation, add to total score a bonus of 500 points for each county you operated in outside of your home county. A minimum of 10 contacts must be made in each county to qualify for bonus points.

AWARDS:

Plaques will go to the highest-scoring stations in the following categories: Tennessee home, Tennessee mobile, Tennessee portable, and out-of-state. First-place certificates will go to the highest-scoring stations in the following categories: Tennessee phone-only, Tennessee CW-only, Tennessee Novice/Technician, each state, Canada, DX entry, out-of-state Novice/Technician.

ENTRIES:

Logs must contain date/time (UTC), station worked, band, mode, exchange, and score. Logs must be legible to avoid disqualification. Submit cross-check sheets (similar to ARRL Form CD-77) for each band and mode which has over 100 contacts.

Mobiles compete against mobiles, portables against portables. No county-line operation for multiple contacts. Portable stations must set up as per Field Day rules. Single-transmitter entries only are allowed. Repeater contacts are not allowed. No list operation permitted. Contestants may work the same station on different bands, modes, and counties in Tennessee.

Logs must be postmarked no later than May 1, 1985. Send a business-size SASE to ensure return of your log and receipt of results and certificates. Mail to TN QSO, Attn. Jack Byrd KF4VL, PO Box 65, Pleasant View TN 37146.

RIO CW DX PARTY
Starts: 1500 UTC March 30
Ends: 1500 UTC March 31

Sponsored by the Pica-Pau Carioca (Rio Woodpeckers CW Group), PO Box 2673, 20001 Rio de Janeiro, RJ, Brazil, with the cooperation of all other Brazilian CW groups. The purpose is to promote 2-way CW contacts between Brazilian and DX stations, enabling DX stations to obtain QSLs valid for several Brazilian awards. The event is held twice each year on the last full weekend in March and the second full weekend in October.

The general call is "CQ RIO DX PTY." Use all HF amateur bands within your own license authority. Exchange RST, name, and QTH. There are no logs, but quick QSLing (via bureau or direct) is essential.

Reference frequencies are as follows: 3510/3520, 7020/7030, 14030/14050, 21030/21050, 21130/21150, 28030/28050.

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

Spring is coming, and in another month or so, it will be time to climb up on that tower and clean up the antenna connections. For now, let's just satisfy ourselves with cleaning up some of the mess around the shack, OK?

One local ham who is trying to do just that by putting a piece of equipment to good use is Fred Wood WB3JKC, from here in Baltimore MD. Fred would like to use a Teletype® Model 35 teleprinter as an output device for his Radio Shack TRS-80 Color Computer®. Well, Fred, you've really got only two problems. First of all, you need to get a signal out of the CoCo that can drive the teleprinter. Then you have to get the signal into the teleprinter at suitable levels. Let's deal with the second problem first.

The signal coming out of the CoCo serial port is at RS-232 levels, whereas the teleprinter expects a "current-loop" signal of 20 mA or 60 mA, switched on for mark and off for space. There have been several schemes published for converting these; you might look back at this column, in the May, 1984, issue of *73* for one such circuit. This is specifically designed for interfacing an RS-232 signal to a Model 33 or Model 35 teleprinter.

As to the CoCo itself, there are two changes that need to be effected before you can print to the port. First, the CoCo comes up with the port set at a speed of 600 baud. This can be changed to the teleprinter's 110 baud with a POKE to the correct memory address. Next, the CoCo is programmed to check for a character-received signal after every character is sent. With a bit of programming, this feature can also be defeated so that you won't have to hard-wire a high signal on the input pin.

The completed program is shown in Fig. 1, and I think you will find that it sends the data out to the serial port just as you like. For those interested, I have also included alternate POKEs for some other popular baud rates (Fig. 3).

Another ham trying to hook up a teleprinter is Emil Kalar W0DXV, from South International Falls MN. Emil asks some basic questions regarding a, you will pardon the expression, RTTY loop. It's been a while since we covered this basic bit of RTTY information. Emil asks:

What is the dc voltage and current used in the signal loop? Teleprinters have been run on voltage levels as low as twelve volts (and maybe lower than that) and as high as three hundred volts. Although the exact voltage is not critical, I guess the average is around one hundred to one hundred fifty volts. The reasons for the higher voltage have to do with the collapse and reestablishment of the magnetic field around the selector magnets during the mark-space and space-mark transitions. The higher the voltage, the quicker the transition, thus, the less chance for errors in decoding. Nonetheless, portable RTTY stations have used twelve-volt batteries as loop supplies. Now, current is another matter. Older RTTY machines, such as the venerable Model 15, were designed to operate on a current loop of 60 mA. Newer ones, such as the Model 33, run on a loop of 20 mA. However, some Model 33s have been set up to run on 60 mA, and that should be printed on the printed circuit card on the right side of the machine. With the 33, when in doubt, assume 20 mA. Since the resistance of the selector magnets is on the order of 100 Ohms or so, this means that at a voltage level of, say, 150 volts, the loop would draw (remembering Ohm's Law) 150 volts divided by 100 Ohms, or 1.5 Amps! Therefore, in order to keep this current in line, a series resistance of 150 volts divided by 0.020 Amps, 7500 Ohms, would be needed. By the way, this needs to be a big resistor, as the dissipation would be 150 volts times 0.020 Amps, or 3 Watts, minimum. Make it at least six Watts to be sure.

```
10 ' 110 BAUD OUTPUT THROUGH
20 ' COCO SERIAL PORT
30 ' RTTY LOOP—MARCH 1985
40 ' MARC I. LEAVEY, M.D.
50 POKE &H95,&H01:POKE &H96,&HF6:' 110 BAUD
60 POKE &HFF23,&H30:' THESE POKES
70 POKE &HFF22,&HF9:' DISABLE THE
80 POKE &HFF23,&H34:' PRINTER HIGH
90 POKE &HFF22,&H00:' SIGNAL REQUIREMENT
```

Fig. 1. CoCo RTTY output program.

```
      +---------------------------------+
      :                                 :
+--------+                        +--------+
: Loop   :                        :Printer:
:Supply  :                        +--------+
+=======+                              :
: Demod  :                        +--------+
+--------+                        :  Key   :
      :                           : board  :
      :                           +--------+
      :                                 :
      +----/\/\/\/\/--------------------+
           Resistor
```

Fig. 2. A simple RTTY loop.

Baud Rate	POKE &H95	POKE &H96
45.45	&H04	&HC7
75	&H02	&HE3
300	&H00	&HB4
1200	&H00	&H28

Fig. 3. Baud rate POKE values.

Is the loop out from TU connected in series with the dc power? The loop, as its name implies, is a series circuit which encompasses the terminal unit, loop supply, printer, keyboard, and whatever accessories are to be keyed by the loop. Since terminal units often include a loop supply, this may not be a separate item. Fig. 2 is a diagram of a very basic RTTY loop.

Does the dc and signal loop connect to terminals 6 and 7? Emil is referencing the "RTTY Loop" column of October, 1984, where a diagram of a Model 33 terminal strip is given. Yes, these two connections would feed the printer.

Is the loop switched to terminals 3 and 4 to send from the 33 keyboard? No. You don't switch the loop, but rather include in it all that is to be included. So, if you wanted the keyboard to be active at all times, echo on the printer, and key the same loop as keys the printer, you would use only terminals 3 and 7, putting the printer and keyboard in series. If, on the other hand, you wanted to separate the keyboard and printer, relying on the receiving device to echo the sent character back to the printer, then you would remove the "common" between terminals 4 and 8 and connect the keyboard to the sending terminals, and the printer to the receiving terminals, of the equipment.

I hope this information is useful and

wish you well in your endeavors. Let me know how things work out.

Regards to George Francis, PhD, W3ASE, in Millersville, Pennsylvania. George wrote me a letter saying that a former student of his is looking to put a vintage 6800 computer onto RTTY and wonders where he could find some programming help. Well, I published several programs for the 6800 here back in June and July of 1977 and 1978. Copies of these have been sent to George, and I recommend them as good references to anyone attempting to write machine-language RTTY programs on a microcomputer.

Speaking of microcomputers, it is time for what has become a monthly question. This month, and I shudder at the response, I would like to hear from all the Commodore owners out there. Tell me what kind of RTTY programming you are using on your VIC-20 or C-64. What do you like about it, and what don't you like about it? How easy, or hard, was it to get on the air? You get the idea. For those who came in late, the past two months have asked about TI-99/4A and Apple II/II+/IIe/IIc computers. The purpose of all this is to try to compile some sort of order out of the chaos of available RTTY programming, which I shall present here when completed. No need to write anything elaborate, a postcard will do quite nicely. And yes, manufacturers are welcome to respond to this survey as well, although I will categorize their responses differently than those of users.

Interest in the "RTTY Loop" reprint series continues unabated. To recap, there are several complied reprints of information presented years ago in this column. For a list of what is available, send a self-addressed, stamped envelope to me at the above address, requesting the list of reprints available. Of course, I am always happy to hear from you on any RTTY or computer-related topic, and the questions you ask provide me with the sense of direction I take here. Be sure to enclose that self-addressed, *stamped* envelope if you desire a personal reply; otherwise, watch for the answer here, in "RTTY Loop."

FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

HOW HAMS VIEW THEMSELVES

It's that time of year again. The temperature is rising, the birds are singing, the sun is shining, and the Fun! Poll has again returned.

This year we mark the poll's fifth anniversary. Since our first survey ran back in 1981, our hobby has experienced a full spectrum of changes, including volunteer licensing, new bands, hams in space, and the advent of microcomputers. The poll, over the years, has kept tabs on these trends and noted the hobby's gradually changing character. We've seen good changes—such as an increase in the ranks of Advanced- and Extra-class licensees—and some disturbing trends—such as the gradual aging of the overall ham population. But, overall, the poll has helped us to understand our hobby a little better.

This year, as in previous Fun! Polls, we're retaining many old questions to track developing trends in our hobby and adding some new ones to keep up with the times. Whatever your views, send your responses to PO Box 73, Middle Village NY 11379. Or, if you've given up on the US Mule, you can transmit your answers electronically. My CompuServe ID is 70007,412 (CIS) or 76004,174 (EIS). My Source ID, if you prefer that system, is TCU335. You may also contact me via MCI Mail; just type my name at the "To:" prompt.

ELEMENT 1 BACKGROUND

1) Sex:
A) Male
B) Female

2) Age:
A) 15 or below
B) 16-21
C) 22-39
D) 40-59
E) 60 or above

3) License class:
A) Novice
B) Technician
C) General
D) Advanced
E) Extra

4) Number of years licensed:
A) 1 year or less
B) 1-5 years
C) 6-10 years
D) 11-20 years
E) 21 years and up

5) Do you have a new (post-March '78) call?
A) Yes
B) No

6) How many hours a week do you devote to amateur radio?
A) 0-1 hour
B) 2-5 hours
C) 6-10 hours
D) 11-20 hours
E) 21 hours or more

7) Which HF band do you use most?
A) 80-75 meters
B) 40 meters
C) 20 meters
D) 15 and/or 10 meters
E) Don't operate HF

8) Which VHF-UHF band do you use most?
A) 6 meters
B) 2 meters
C) 220 MHz
D) 420 MHz and/or up
E) Don't operate VHF-UHF

9) Which mode do you use most?
A) SSB
B) CW
C) FM
D) RTTY
E) Other

10) How much money have you spent on amateur radio within the past year? (Include OSL expenses, magazine subscriptions, club dues, and other incidental expenses.)
A) 0-$250
B) $251-500
C) $501-$1,000
D) $1,001-$2,500
E) $2,501 and up

ELEMENT 2 SOCIAL CHARACTERISTICS

11) On the whole, hams are:
A) too young
B) too old
C) just the right age

12) Do you wear a pocket saver?
A) Yes
B) No

13) Politically, how would you define yourself?
A) Conservative
B) Middle-of-the-road
C) Liberal

14) Should we get rid of the ARRL?
A) Yes
B) No

15) How old were you when you first became a ham?
A) 15 or below
B) 16-21
C) 22-39
D) 40-59
E) 60 or above

16) Should the FCC increase the speeds on amateur CW examinations?
A) Yes
B) No

17) Do you own a home computer?
A) Yes
B) No

18) If you answered "yes" to question 17, which brand?
A) Apple
B) IBM
C) Radio Shack
D) Commodore
E) Other

19) Do you think that home computing is siphoning people (including youngsters) away from amateur radio?
A) Yes
B) No

20) Do you think the volunteer exam system has increased cheating?
A) Yes
B) No

21) Do business interests deserve some of our virtually abandoned bands?
A) Yes
B) No

22) Should ham licenses have a minimum age requirement?
A) Yes
B) No

23) Should ham licenses have a maximum age requirement?
A) Yes
B) No

24) Should hams be subject to periodic retesting?
A) Yes
B) No

ELEMENT 3 OPERATING HABITS

25) If the users were restricted to data communication only (no phone or CW operation), would you be in favor of a no-code 220-MHz Digital-class license?
A) Yes
B) No

RESPONSE FORM

Instructions: Read each question and mark your response by circling the appropriate letter next to the number of the question.

Element 1:	*Element 2:*	21) A B	30) A B	41) A B
1) A B	11) A B C	22) A B	31) A B	42) A B
2) A B C D E	12) A B	23) A B	32) A B	43) A B
3) A B C D E	13) A B C	24) A B	33) A B C D E	44) A B
4) A B C D E	14) A B		34) A B C D E	45) A B C D E
5) A B	15) A B C D E	*Element 3:*	35) A B	46) A B C D E
6) A B C D E	16) A B	25) A B	36) A B	47) A B C D E
7) A B C D E	17) A B	26) A B	37) A B	48) A B C D E
8) A B C D E	18) A B C D E	27) A B	38) A B	49) A B
9) A B C D E	19) A B	28) A B	39) A B C D E	50) A B
10) A B C D E	20) A B	29) A B	40) A B	

Comments: ______________________________

26) Would you be in favor of a no-code 220-MHz Digital-class ticket if it permitted phone operation in addition to data transmission?
A) Yes
B) No

27) Have you ever used a personal computer in connection with your amateur-radio activities?
A) Yes
B) No

28) Is it time to completely deregulate amateur radio by having the FCC turn over all responsibility for ham operation to the amateur community?
A) Yes
B) No

29) What do you think of people who view pay television services with MDS converters and satellite dishes that are not approved by broadcasters?
A) They're skunks
B) They're within their rights

30) Should we get rid of, or reduce in size, the CW subbands?
A) Yes
B) No

31) Do you think DX nets have a place in ham radio?
A) Yes
B) No

32) Do you think nets in general have a place in ham radio?
A) Yes
B) No

33) The next time a ham operates from space, which band should he/she use?
A) 2 meters
B) 220 MHz
C) 450 MHz
D) An even higher band
E) Shouldn't bother to operate

34) If, while tuning across a band, you heard a net called "Jammers International" in progress, would you:
A) Jam it
B) Ignore it
C) Complain to the FCC or some other organization
D) Listen
E) Join it

35) If required, could you solidly copy CW at the speed at which you were licensed?
A) Yes
B) No

36) If required, could you pass the FCC theory test for your license class?
A) Yes
B) No

37) Have you ever purposely operated in an amateur subband you weren't licensed to use?
A) Yes
B) No

38) Are you fluent in any computer language?
A) Yes
B) No

39) If you answered "yes" to question 38, which language?
A) Basic
B) Pascal
C) Assembler
D) Machine
E) Other

40) Do you feel yourself competent to write a short Basic program?
A) Yes
B) No

41) Do you feel yourself competent to replace the finals in a transistor-type rig?
A) Yes
B) No

42) Do you solder together your own coax connectors?
A) Yes
B) No

43) Is your antenna system mounted on your house or a tower?
A) House
B) Tower

44) Have you ever designed your own antenna?
A) Yes
B) No

45) What do you think of contesting?
A) Great
B) Good
C) Okay
D) Don't like it
E) Despise it

46) What do you think of DXing?
A) Great
B) Good
C) Okay
D) Don't like it
E) Despise it

47) What do you think of repeaters?
A) Great
B) Good
C) Okay
D) Don't like them
E) Despise them

48) What do you think of traffic handling?
A) Great
B) Good
C) Okay
D) Don't like it
E) Despise it

49) If you heard an emergency net in progress, would you immediately join in and offer your services?
A) Yes
B) No

50) Have you ever secretly hoped for a minor disaster to strike your community just so you could demonstrate your radio skills?
A) Yes
B) No

SATELLITES

USING THE AO-10 APOGEE PREDICTIONS

Apogee predictions for the month of March are provided for three sections of the United States: Washington DC at 39N 77W, Kansas at 39N 95W, and California at 38N 122W. Times are in UTC and apogee in this case is mean anomaly 128 rounded to the nearest whole hour. Use the chart as a guide in aiming your antenna, then fine-tune the azimuth and elevation values to peak the satellite's beacon signal. If you require more accurate orbital predictions, contact AMSAT at PO Box 27, Washington DC 20044.

AMSAT-OSCAR 10 APOGEE PREDICTIONS
MARCH 1985

			WASH		KANSAS		CALIF	
ORBIT	DAY	TIME	AZ	EL	AZ	EL	AZ	EL
1291	1	2000	255	17	241	30	209	48
1293	2	2000	249	18	233	31	199	46
1295	3	1900	241	28	221	40	180	49
1297	4	1800	230	37	206	46	160	49
1299	5	1800	222	37	197	45	154	44
1301	6	1700	208	44	179	48	138	40
1303	7	1600	190	49	160	47	124	33
1305	8	1600	181	46	154	42	122	27
1307	9	1500	163	46	138	38	111	20
1309	10	1400	145	43	124	32	102	11
1311	11	1300	130	37	113	24	94	3
1313	12	1300	127	31	112	18		
1315	13	1200	116	24	102	10		
1317	14	1100	106	16	94	2		
1318	14	2300					260	7
1319	15	1100	105	10				
1320	15	2200					253	17
1321	16	1000	96	2				
1322	16	2200					247	19
1324	17	2100			259	8	238	29
1326	18	2000	264	3	252	17	228	37
1328	19	2000	258	5	245	19	219	38
1330	20	1900	251	15	236	28	205	44
1332	21	1800	243	24	225	37	187	48
1334	22	1800	236	26	217	37	178	45
1336	23	1700	226	34	203	43	160	45
1338	24	1600	213	41	185	47	143	41
1340	25	1600	204	40	177	43	139	35
1342	26	1500	187	44	159	43	126	29
1344	27	1400	169	46	143	39	115	22
1346	28	1400	162	41	139	34	113	16
1348	29	1300	146	38	126	28	104	8
1350	30	1200	132	33	115	20	96	0
1352	31	1100	120	26	106	12		

HAM HELP

We are happy to provide Ham Help listings free, on a space-available basis. We are not happy when we have to take time from other duties to decipher cryptic notes scrawled illegibly on dog-eared postcards and odd-sized scraps of paper. Please type or print your request (neatly!), double spaced, on an 8½"×11" sheet of paper and use upper- and lowercase letters where appropriate. Also, please make a "1" look like a "1," not an "l," which could be an "el" or an "eye." and so on. Hard as it may be to believe, we are not familiar with every piece of equipment manufactured on Earth for the last 50 years! Thanks for your cooperation.

Does anyone have any information on modifying the Kenwood TS-180S agc circuit to allow faster recovery time and improved performance on AMTOR?

L. E. Rhodes K8RRB
550 York St.
Bad Axe MI 48413

Wanted: Schematic for a Dynamic Communications (DyComm) mobile/repeater system.

Keith Kerchner KC9IH
Rte 1 Box 91
Edelstein IL 61528

I need a schematic and a transformer for an Elco model 751 power supply. Also, I need a switch for an Elco 753 transceiver; it's marked "S3D" on the schematic for the tank circuit. Has anyone successfully modified the 753 to eliminate its drift problem?

Patrick Benesch KB4EGJ
PO Box 459
Loyall KY 40854

I need an instruction manual and circuit diagram for a Code-A-Phone 700 telephone answering system. Can anyone help?

M. Garey W6RNE
24771 Kay Ave.
Hayward CA 94545

I need volume 9 of the CREI Advanced Electronic Engineering Technology home-study course to make the set useful. A photocopy is fine, and I will pay the charges.

Clem Small KR6A
26530 Parkside Dr.
Hayward CA 94542

I have a Midland 13-893 AM/SSB CB. Does anyone have information on how to convert this to 15 or 10 meters? I will gladly pay for copying costs and postage.

Stephen Rehberg N6KZU
322 E. Mayfair Ave.
Stockton CA 95207

I would like the schematic and service or operation manual for the following equipment: model 84-R signal generator manufactured by Measurements Corporation, model 1604 multimeter manufactured by Stark, and model 1606A RF Bridge manufactured by General Radio. I will gladly pay copying and postage charges.

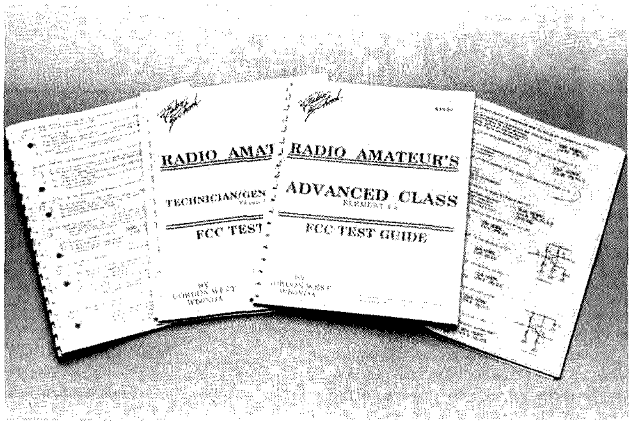
Robert Sondack VE2ASL
260 Rue Bellerive
St. Luc Quebec
Canada J0J 2A0

Does anybody have information on how to build a ferrite-bead antenna?

Marvin Rosen N3BQA
20 W. Madison Street
Baltimore MD 21201

✓ See List of Advertisers on page 80

NEW PRODUCTS



New series of FCC test guides by Radio School.

COMPUTERWARE INTRODUCES INVENTORY SYSTEM

Computerware has introduced their Manufacturer's Inventory System which is now available for CP/M and MSDOS computer systems. This comprehensive system is specifically designed to meet the special needs of the small- or medium-sized manufacturer.

Going beyond the usual tracking of inventory items and costs, this system includes features like bills-of-materials, parts projections for "what-if" production planning, where-used lists, reorder reports, sales analysis, component shortage reports, and much more. It helps keep a healthy level of inventory—having the right inventory when you need it to keep production flowing without tying up valuable capital in excesses. The projection features are invaluable for planning production and purchasing.

The new visibility provided will increase management's decision-making abillity and help reduce material costs. You will always know what you have on hand, what is on order from your vendors, how much is committed to current production, and the value of your inventory. The system automatically adjusts inventory levels and will recalculate assembly costs with new component prices upon your request. You will be able to recognize fast sellers, slow movers, dead inventory, cyclical sales trends, and components eligible for volume purchases. The system's interactive purchase-order system creates and tracks all purchases, increasing the effectiveness and efficiency of purchasing personnel.

For complete details, contact *Computerware, Box 668, 4403 Manchester Ave. Suite 102, Encinitas CA 92024; (619)-436-3212.* Reader Service number 484.

500K-BYTE MICRO FLOPPY DRIVE

Everett/Charles Marketing Services, Inc., is offering a new 500K-byte, 3½" micro floppy disk drive. The model F353-MFD is a Shugart-compatible, double-density, single-sided disk drive with a formatted capacity of 327.6K bytes employing 80 tracks per inch. Compatible with 5¼" floppy drive controllers, the F353-MFD uses Sony media and a standard IBM format.

The unit is mounted on a compact chassis with a height of 32 mm, a width 104 mm, and a depth of 162 mm and weighs only 600 grams. An ultra-thin hybrid stepping motor is used along with a steel-belt drive system to ensure high precision during head positioning. In the disk tracking mechanism, a highly reliable spindle hub is used which incorporates a direct-drive brushless motor.

The model F353-MFD also features an automatic power-down control. If no commands are sent to the stepping motor during a given period of time, the drive will automatically enter a "power-save" mode.

For further information, contact *Everett/Charles Marketing Services, Inc., 6101 Cherry Ave., Fontana CA 92335; (800)-443-1860.* Reader Service number 476.

RADIO SCHOOL TEST GUIDES

Gordon West's Radio School has announced the availability of their test guides for every amateur-radio class of license. Originally developed solely for Gordon West's own ham-radio classes in southern California, the test guides have been used by amateur-radio operators *throughout the country* to successfully pass the new volunteer-administered examinations.

The Radio School test guides list all 500 test questions plus the multiple-choice answers in an 8½" × 11" manual. The exact questions plus the exact distractors (wrong answers) and the exact correct answer are listed as they will be found on ARRL or W5YI volunteer examinations. The General- and Advanced-class test guides list 500 questions, the Extra-class test guide has 400 questions, and the Novice-class test guide covers 200 questions.

Each test guide also lists study notes that reflect reference material on where the questions are derived and where to find out more information about the answers. Formulas for solving the problems are also incorporated in each test guide.

Included in all test guides are several pages of instructions to the applicant on where to locate a Volunteer Exam Coordinator and how to sign up for a local volunteer-administered examination. Also included are the necessary test forms that applicants must fill out ahead of time, including the new FCC Form 610.

For more information on study guides, code and theory training tapes, and a colorful catalog of amateur-radio instruction material, write *Gordon West's Radio School, 2414 College Drive, Costa Mesa CA 92626; (714)-549-5000.* Reader Service number 479.

RBBS/64 MAILBOX

Computerstuff has announced the release of RBBS/64 amateur-radio mailbox software for Commodore computers.

RBBS/64 is a full-featured radio-bulletin-board program for use with the Commodore 64 and 1541 disk drive. Thirty user commands are available to allow the calling station to create, review, save, and read messages. Advanced capabilities include: automatic logging of user callsign, time and date of access, automatic clock/calendar updates for weeks of unattended use, automatic system shutdown in the event of a component failure, a file-protect option for read-only messages, serial printer support, baud/mode change, expert-user mode, and full directory and storage for up to 100 messages. A break-in mode allows the sysop to modify system parameters, set the Beacon mode, and directly communicate with other stations without stopping the program.

A special configuration program is included which will automatically format and prepare a disk and encode it with the owners call, QTH, and system baud rate (60–132-wpm Murray or 110–1200-baud ASCII), eliminating the need for manually reentering the information each time the system is loaded. A third program included with the RBBS/64 system is a powerful file editor which allows the operator to examine, print, update, edit, or delete messages, convert programs to RBBS/64 format, and view or print the user log.

Detailed information and order forms for RBBS/64 may be obtained by writing to *Computerstuff, 308½ Green St., Yankton SD 57078; (605)-665-2833.* Reader Service number 481.

HOW TO SELL SOFTWARE

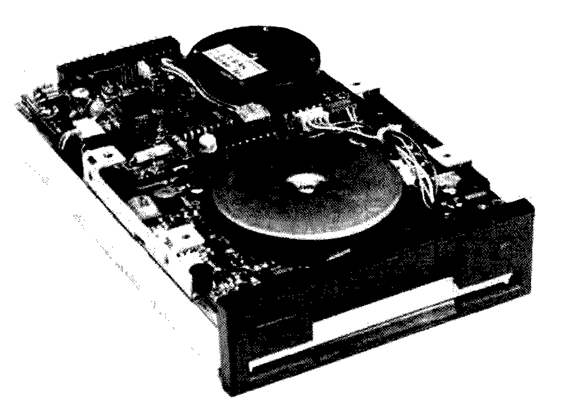
Associated Technology has announced a new book for the success-oriented professional titled, "How to Sell Your Radio Applications Software."

The manual tells how to obtain national directory listings, how to price a new software product, how to locate and qualify a new advertiser, how to write a user's manual, and how to operate a successful mail-order fulfillment service. The manual guides budding entrepreneurs through the maze of problems which can limit the exposure of innovative software products.

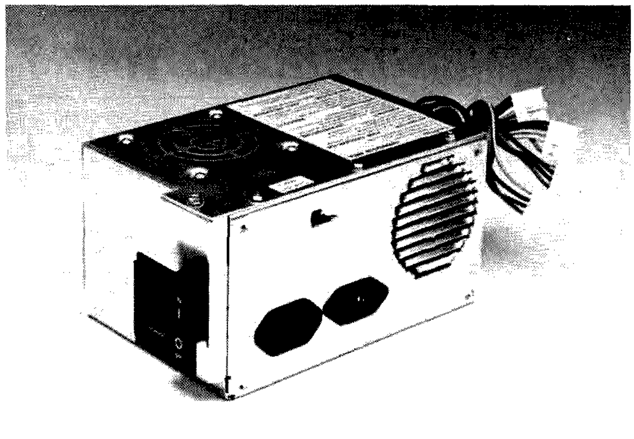
For further details, contact *ATC, Rt. 2 Box 448, Estill Springs TN 37330.* Reader Service number 483.

ADTECH SWITCHING SUPPLIES

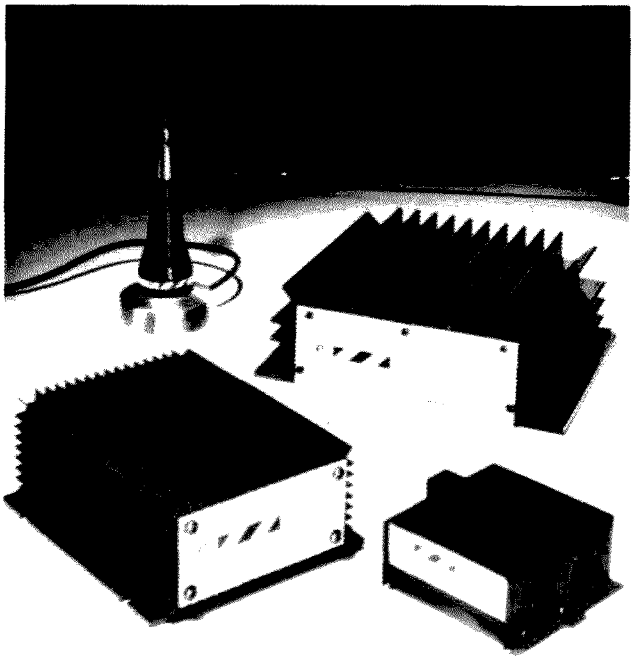
Adtech Power has announced the latest addition to their line of switching power supplies. Model 4KS-150-IBM is a



500K micro floppy drive from Everett/Charles.



Adtech's switching power supply.



Antenna Specialists' line of VHF/UHF amplifiers.

Ten-foot mesh dish from Kaul-Tronics.

fit, form, and function replacement for IBM's PC and XT power supplies.

The 4KS-150-IBM is a four-output, 150-Watt supply that allows PC and XT users to upgrade their computers by taking advantage of the increased power over the 63.5 Watts of the PC and the 130 Watts of the XT. Since the 4KS-150-IBM fits the exact form and has the exact pinout of the less powerful PC and XT supplies, it is a simple matter to add a color-graphics card, hard-disk controller, etc.

For further information, contact *Adtech Sales, 1620 South Sunkist Street, Anaheim CA 92806; (714)-634-9211.* Reader Service number 480.

RF AMPLIFIERS BY ANTENNA SPECIALISTS

The Antenna Specialists Co. has introduced a newly designed, greatly expanded line of rf power amplifiers to accommodate virtually any needed land-mobile application. Twelve new models, from low band through UHF, were introduced simultaneously. A 50-Watt and a 75-Watt unit are available for 35 to 50 MHz, with similar models for mid-band operation. Four amplifiers, ranging from 25 to 100 Watts output power, are available in VHF frequencies from 144 to 174 MHz. An additional four models cover the UHF band from 432 to 512 MHz with output power from 25 to 80 Watts. The new line is offered at prices lower than the company's previous amplifier products, despite engineering improvements leading to greater reliability. A new package design and construction improve heat dissipation while increasing duty cycle.

For complete information and specifications, contact *The Antenna Specialists Co., Marketing Department, 12435 Euclid Ave., Cleveland OH 44106.* Reader Service number 482.

NICAD EXERCISER

Deisenroth Manufacturing has introduced the Nicad Battery Exerciser, a PC board that can be wired into a battery charger. By just pressing a switch, the Exerciser discharges the battery down to 1 volt per cell, then automatically turns on the charger.

Two major nicad problems can be solved by the Exerciser. The Exerciser eliminates excessive cell-capacity loss—caused by overcharging—with a deep discharge. And cell reversal, which occurs when portable radios are left on until the battery is completely discharged, will be prevented.

The Exerciser will work on batteries from 5 volts to 20 volts. Its small dimensions (1¼" × 1¼") and 3 simple connections make installation in most chargers easy.

For further details, contact *Deisenroth Manufacturing, 575 Montgomery Pike, S. Williamsport PA 17701.* Reader Service number 478.

KAUL-TRONICS TVRO ANTENNA

Kaul-Tronics, Inc., has introduced a 10-foot mesh antenna featuring a completely redesigned rib, permitting production-cost savings and a 30-percent price reduction. A patent has been applied for on the rib design.

The antenna package, which includes the Nova polar mount with self-alligning bearings and a buttonhook feed, weighs just 155 pounds and is UPS-shippable anywhere in the US. The new antenna has an f/D ratio of .375.

Engineered for maximum durability and performance by Kaul-Tronics, the Trans-10 features ribs of tubular 16-gauge steel encased in poly-trans vinyl. The ribs have unobstructed mesh-retaining channels for snug positioning.

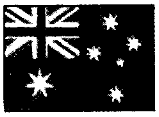
Other dish components are also heavy duty. It has a 14½" parabolically formed prime steel hub that is $^{3}/_{16}$" thick. Its outer rim is made of rigid extruded aluminum and the mesh panels are made of expanded flattened aluminum. The Trans-10 has optional stainless-steel mesh. All antenna hardware is plated for weather protection.

For more information, contact *Kaul-Tronics, Inc., Rte. 2 Box 637, Richland Center WI 53581.* Reader Service number 477.

73 INTERNATIONAL

Each month, 73 brings you ham-radio news from around the world. In this collection of reports from our foreign correspondents, we present the latest news in DX, contests, and events, as well as keep you abreast of the technical achievements of hams in other countries.

If you would like to contribute to your country's column, write to your country's correspondent or to 73 Magazine, Pine Street, Peterborough NH 03458, USA, Attn: Perry Donham KW1O.



AUSTRALIA

J. E. Joyce VK3YJ
44 Wren Street
Altona 3018
Victoria
Australia

After sending out some twenty-five letters to Division and Club Secretaries throughout Australia over the last twelve months, asking for information for this column, I was disappointed, to say the least, at receiving only five replies of which only two gave any information of use to this column.

The following letter from Diana Main VK6KYL, secretary of the Goldfields Amateur Radio Group, shows how a small dedicated group of amateurs can assist the local community and, in turn, be assisted by that same community. There should be more of this type of community involvement in amateur radio as it can only benefit our hobby in the future.

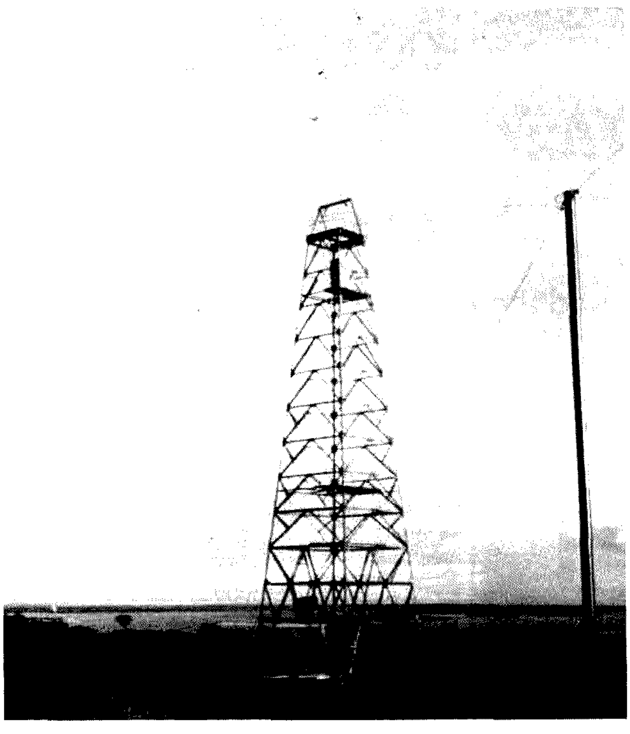
A HISTORY OF THE GOLDFIELDS AMATEUR RADIO GROUP (Western Australia)

Originally known as the Kalgoorlie Repeater Group, the inaugural meeting was held on the 14th June, 1977, and the group was formed to maintain the previously established 2m repeater—VK6RAK—which was, and still is, located at the Hainault Gold Mine. The original office bearers were Lewis VK6ZGO, president, Doug VK6OR, secretary, and Tony VK6BV, treasurer. The decision to affiliate with the Western Australia Repeater Group was the first item on the agenda. There were approximately 10 members at this time, which was 100% of the amateur population.

The group was inactive between July, 1978, and June, 1981, due to work transfers. In June, 1981, the group was reformed, and the name was changed to the Goldfields Amateur Radio Group. The Kalgoorlie Repeater Group ceased to exist. The introduction of the Novice license resulted in an influx of new amateurs and a broadening spectrum of interests.

The office bearers at this time included two of the original group. Lewis VK6ZGO was reelected president and Bruce VK6ZKB, treasurer, and a relatively new amateur, Diana VK6KYL, was elected secretary.

1981 was a busy year for the group. The first inkling of a new repeater at Kambalda emerged with the growing awareness of the increased tourist traffic in the Eastern Goldfields. At this time, the now aging beacon began to misbehave. The unit has proven to be unreliable and was taken off the air pending redesign or replacement when the time and funds are available. JOTA, 1981, saw the full complement of Scout and Guide groups in the area having a total of 5 stations operated by members of the group.



VK6RKB Kambalda. The repeater is in the "thunderbox."

GARG, in October, 1984. Left to right: front row—Herb VK6KHC, Phil W60370 (SWL), Diane VK6KYL, Noel VK6ZAK; center row—Jim VK6ZMR, Warren (SWL), Martin (SWL), Bill VK6ZX, Roy VK6ET; back row—Rob VK6ZMB and Peter VK6PK.

July, 1982, saw a difference of opinion with the local newspaper and a clarification over the misuse of the word ham, which resulted in a half-page article on the group and amateur radio with accompanying photographs. During this period, the idea for a local award was put forward. Members endorsed the idea wholeheartedly, and the name Hainault's Reward was chosen. In the forthcoming months, this idea was borne to fruition. Representatives of the group attended the A.G.M. of the Kalgoorlie "Boulder Tourist Bureau" to present our proposal for an award exemplifying the attractions of the Goldfields. A subtle suggestion for monetary assistance was made and proved more than successful. We now have one of the most sought-after local certificates available in Australia. Details of our certificate are included to whet your appetite.

Hainault's Reward

From the Goldfields Amateur Radio Group of Western Australia. This award is available to all licensed amateurs and SWLs. All contacts made on or after January 1st, 1982, are valid.

Requirements: (a) VK/ZL—Work 5 resident Goldfields amateurs, including 2 GARG members within the 250-km radius of Kalgoorlie. This includes the town of Windarra. (b) Overseas—Work 3 resident Goldfields amateurs, including 1 GARG member within the 250-km radius of Kalgoorlie. This includes the town of Windarra. (c) *Any one contact with the club station, VK6AGF,* is an instant qualifier for the award.

Cost: (a) VK/ZL—$3.00 (Australian) or equivalent, or 8 IRCs; (b) Overseas—$4.00 (Australian) or equivalent, or 10 IRCs.

Application: QSLs are not needed, but a certified extract of your log signed by 2 other amateurs is necessary. Send your application to: The Award Manager, PO Box 463, Kalgoorlie, Western Australia, 6430.

All contacts to be made in accordance with the applicant's license requirements. No official GARG net contacts count. Contacts to be 2-way SSB, CW, FM, or other recognized mode of transmission, no crossmode or crossband contacts except via satellite. All contacts endorsed mobile or portable to be made from the same call area.

1983 was a vintage year. VK6AGF (Australian Gold Fields) became a reality and the group commenced having its monthly meetings in the Theatrette at the Hainault Gold Mine. Our unqualified thanks to Ian Moffatt, the owner of the mine (and now inaugural life member of the Tourist Bureau), for his complete support and cooperation in the establishment of the original repeater, the award, and permanent meeting place.

VK6AGF was first activated at the annual Community Fair where we manned the Tourist Bureau stand and publicized the Goldfields on air and amateur radio to the general public. Fund-raising became a priority and the group made an exceptional effort to accomplish its aim of financial independence. Methods used included a battery drive and club T-shirts screen-printed with the club logo, courtesy of Gina, the wife of Barry VK6NBM (now VK6KIT). Our major money-raising effort was a weekend litter drive around the Kambalda (Western Mining) mine lease. The total monies raised from this effort alone exceeded $400! Safety and security communications have been provided on some occasions for the local motorcycle club.

The Kambalda 2m repeater (VK6RKB) is now close to being fully operational. The first site chosen was a hill overlooking the town of Kambalda where Western Mining had recently vacated a tower and radio hut. Unfortunately, this was later resumed by the company for exploration purposes. Nevertheless, this was a blessing in disguise, as the company then said we could choose any site we liked. Naturally, we looked for a high spot. The ideal site stood out like a sore thumb, or to be more precise, a 30m (100 ft.) disused drilling rig.

Power was the next problem. We noticed that the local TV translator, which was close by, had 3-phase power connected to it. With due disregard for the realities of life, we proceeded to write a letter to Western Mining requesting their cooperation in the erection and supply of single-phase power to the site. We were duly surprised and elated to discover that our request had been complied with and not only at no initial cost to us, but also all future power would be free.

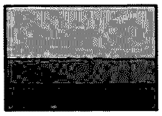
Is this the only repeater in the world to be housed in a thunderbox 30 meters above the ground? (To the uninitiated, a thunderbox is an outdoor toilet.)

The membership today includes satellite enthusiasts VK6ZMR and VK6ZMB, slow-scan from VK6ET, AMTOR from VK6PK and VK6ZX, low-band DX from VK6AS and VK6ZX, computing from VK6AKO, VK6NWS, and others, and, until recently, VK6ACF was our aeronautical medic (Royal Flying Doctor Service).

At present, the Goldfields boasts approximately 30 licensed Amateurs of whom about one third take an active interest in the group's activities.

POINT OF INTEREST

The West Australians (VK6) are now driving around with car number plates stating "W.A.—The Home of the America's Cup."



COLOMBIA

Abelardo (Lalo) Santos V. HK3EQJ
PO Box 88937
Bogota 8
Colombia

NATIONAL VACCINATION CRUSADE

"A first step for Colombia, for its children, a giant step for children everywhere," said James P. Grant, UNICEF Executive Director.

The first of three massive national vaccination journeys in Colombia, with repercussions all over the world, took place June 23 (the second on July 28 and the third of this special health program on August 25, 1984).

This extraordinary event (with the economic help of UNICEF, WHO/PAHO, and UNDP) was organized by the Colombian Health Ministry based on a decision taken only on April 18 of this year. One can easily imagine the efforts made by all involved in order to meet the goals within the given dates. Eight hundred thousand Colombian children below four years old were immunized against five deadly diseases, namely, diptheria, polio, tetanus, pertussis, and measles.

To be present for the second vaccination journey, James P. Grant, the UNICEF executive director, came to Bogota the 27th of July. On arrival at El Dorado Airport, he commented to the world press waiting for his arrival: "The eyes of many around the world are on Colombia this summer—for example, 18 health experts from Upper Volta arrived here yesterday to observe your experience in Colombia." (Teams of observers from Ecuador, El Salvador, Haiti, and the Dominican Republic also were present.)

"In many ways, if you are as successful on the second and third of these national immunization days as the first, it is equal in importance to the first step that was taken on the moon, 15 years ago. You will remember when that first astronaut went to the moon, when he took his first step. This immunization program in Colombia is a first step for Colombia, for its children, a giant step for children everywhere."

The Colombian Radio Amateur League was requested by the Bogota D.E. Health Authorities to provide essential radio communications for the vaccination team covering the most needy, poverty-ridden inhabitants of the southwestern part of the capital city, where not even public telephones exist.

The Emergency Operations Committee of the LCRA was entrusted with this task, and its coordination was assigned to Armando Vargas HK3DPG, who gathered some forty volunteer colleagues provided with 2-meter hand-helds for mobile operation and two base stations, one manned by Oliverio HK3CQG and Atanacio HK3BBJ (located at the Santa Clara Hospital) and the second by Lalo HK3EQJ, at the Bosa Municipal Hospital.

Teams of doctors plus one coordinator (Dr. Hans Naihaus) were visiting from 0700 to 1700 all the vaccination posts in the wide area, providing advice, keeping the vaccine stocks replenished, supervising the statistical work, and, of course, giving the food and soft-drinks logistic support for everybody involved in the operation.

The 7390 Bogota District LCRA repeater was permanently manned and extremely busy during the whole day on the vaccination journeys. Spare sets and replacement batteries were provided on demand, and rotation of the operators took place without any difficulties.

Previous day meetings were held at the LCRA Headquarters and last-minute instructions were exchanged under the coordinator's scrutiny and in the light of suggestions made by the health authority's liaison officer, Dr. Jaime Rosas—who was so pleased and impressed with the radio amateurs' effective and smooth performance that he decided to become an amateur himself.

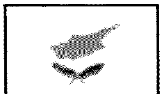
Dalia HK3JI also was there, working with the coordinator, and was immediately contacted by all the team communications officers (including Humberto HK3DHM, Alberto HK3FXE, German HK3HDT, and Gilberto HK3GRB when two boxes of sandwiches mysteriously disappeared precisely at the lunch time, and calm was returned to the hungry crowd when Jaime HK3GWM and Carlos HK3BFU relayed the orders given by the Supply Officer whereby chicken and hamburgers would replace the lost rations.

The action went on and on all over the country; problems were unavoidable but promptly solved when the news was given to the proper authorities. An almost lost village in the jungles of Choco Province did not have any vaccination shots for its children due to not having received the supplies sent from Bogota. Well, the Colombian President, Mr. Belisario Betancourt himself, ordered his personal helicopter to be immediately rushed to the spot.

The order was so hastily executed that when the team had landed with the vaccine and therefore the mission was accomplished—oops!! The pilot noticed that there was not enough fuel for the return flight. For this, a second flight was organized and the problem solved.

For the third vaccination journey, there were six hundred thousand more polio vaccine doses needed; the Argentine government came to the rescue, and their Health Ministry proceeded to air-ship the badly needed vaccine.

For the three vaccination dates, alphabetization teams from exclusive Northern Bogota's schools were assigned to help as vaccination assistants. The meeting place at dawn was at The Heroes Monument Square, with a short stopover at Santa Clara's Hospital for final instructions and delivery of health supplies entrusted to them. The transport arrangements were made for specially-hired intermunicipal buses. One of the drivers from the Boyaca Province was not at all familiar with the Bogota daredevil driving habits; he was stranded with his precious 50 pupil passengers and everybody at Santa Clara was panic stricken. After an extremely long hour of waiting, he finally showed up with a wide smile, saying: "Sorry, I missed a turning!"



CYPRUS

Aris Kaponides 5B4JE
PO Box 1723
Limassol
Cyprus

With the coming of autumn and winter, quite a few Cyprus amateurs, both 5B4s and ZC4s, have been active on any band which had reasonable propagation. Some Cypriot amateurs are very active on RTTY, usually during the afternoons on 20m. On RTTY can be heard 5B4MC, 5B4IT, 5B4MD, 5B4QP, 5B4NG, 5B4CV, 5B4EP, and very soon 5B4OJ, 5B4OV, and 5B4JE hopefully will be also active on this mode with home-brew interfaces and terminal units.

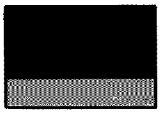
Very recently a group of amateurs from the southern part of Cyprus formed a net on 28.500 MHz which meets on Mondays, Wednesdays, and Saturdays at 1800 UTC. The net was named by OM Andy ZC4HA the "Aphrodite Net," Cyprus having been known in ancient times as the birthplace of Aphrodite, goddess of love. On the net come up regularly Andy 5B4DN, Lucas 5B4BS, Nicos 5B4CV, Aris 5B4JE, and from the ZC4 side, Andy ZC4HA, Allan ZC4AB, and Jim ZC4JE. The whole group will welcome any breakers when the band opens from any part of the world. All the stations are equipped with beams, most of them home-brew, and if the band will open for the winter period we are sure that old Aphrodite will put up a fine show.

At the end of September we had the annual International Rothmanns Cyprus Rally. Many drivers from many countries took part, and the friends of this sport were focused on Cyprus for three days. Every year Cyprus radio amateurs help with the communications, using 2m, providing a very efficient service. The fellow in charge for the rally communications was Chris 5B4EI, a broadcast engineer, who did an excellent job.

The club stations in Cyprus are operated once a week, and more members and friends are using them. The Limassol club obtained recently an FT-757GX transceiver by Yaesu, almost half-price through Telectronics Communications, Ltd., in Limassol, and all club members would like to thank them for their most generous gesture. We do hope that other firms will follow their example. Club stations in small places like Cyprus need all the help they can get.

Another repeater was activated in October. This is a UHF repeater set up on Troodos mountain, and it covers most of the island. Neighboring countries should also be able to open it during summertime on tropo. It receives on 434.8 MHz and transmits on 439.6 MHz. Cyprus now has four VHF repeaters, R2, R4, R5, and R8 and the recent UHF one. Lots of visitors as well as local amateurs are keeping them very busy.

Christmas is coming soon—as I write this—and most of the amateurs and their friends will meet in Nicosia at their annual Christmas dance. New friendships and new acquaintances will be made and everybody will have an excellent time, thus showing amateur radio at its best.



FEDERAL REPUBLIC OF GERMANY

Hans J. Schalk DJ8BT
Hammarskjold-Ring 174
D 6000 Frankfurt 50
Federal Republic of Germany

Up to now the facsimile mode in the Amateur Radio Service could be of little use. This is due to a small supply of those facsimile (FAX) machines and unreasonable prices. In the past two years, however, amateurs were able to obtain several surplus Telecopy machines. This situation caused an increased activity on all amateur bands.

Presently, there are over 30 FAX stations from eight European countries (DL, EA, F, G, HB, LA, LX, and OE) QRV and active on the shortwave bands. After the weekly *FAX Bulletins* or on the activity day (Wednesday 1800 to 2000 UTC), the FAX friends meet together on 80 or 20 meters. The *FAX Bulletin* schedules are Saturday, 1800 UTC, 3600 kHz, and Sunday, 0900 UTC, 14100 kHz (beaming USA).

Additionally, the *FAX Bulletin* is transmitted on VHF and UHF in several regions of the Federal Republic of Germany. Transmissions contain the DL broadcast from DARC (Deutscher Amateur Radio Club) and the actual weather forecast chart (by DL5EJ) as well as the *FAX Bulletin* by DJ8BT. The *FAX Bulletin* is published monthly and contains news from the

scene of facsimile as it is used by radio amateurs.

Once in the year, on the third weekend in October, an international FAX contest takes place. One purpose of this contest is the testing of one's own station and operational abilities under difficult conditions. The FAX contest is sponsored by the DARC and was a great success last year. The D-F-D award (Deutsches FAX Diplom), sponsored by the GARTG (German Amateur Radio Teleprinter Group), is also supporting these activities.

A FAX QSO can be established on the shortwave bands as an independent mode of operation. For arrangements of transmissions, occasionally the SSB mode will be used. On the shortwave bands, FAX traffic takes place on 3600 kHz, 7040 kHz, 14100 kHz, 21150 kHz, and 28200 kHz, plus/minus 5-kHz variation.

Transmissions will be handled in F1C/F3C respective J2C/J3C with a shift from 400 Hz. According to CCITT (Committee Consultative International Telegraphique et Telephonique) recommendation T16, white in HF position should be the higher frequency. Depending on the volume of transmitted messages (small or large pixels), the bandwidth varies from 1500 up to 3000 Hz.

The Amateur Radio Service uses, as do commercial radio services, a drum speed of 120 rpm, corresponding to 120 lines per minute. All transmissions will be operated with an IOC (Index of Cooperation) of 288 and/or 264. The transmission of a message upon a 13" standard page size takes almost 10 minutes.

As a rule, a CQ call will be helpful prior to the start of a FAX QSO. For this purpose, each FAX station has created his own special CQ card. This card contains the request for a QSO, references for linearity and aperture distortion, as well as other information concerning the transmitting station. (An ATV test chart is comparable.)

To reduce the transmitting time, the CQ card should use a smaller format then any standard pages. If the CQ call is successful, a short personal introduction will be given. For this purpose, the name and the QTH are already prepared on a chart, ready for transmission. On all charts the own call and the call of the QSO partner are reported. Any ID in another mode is, according to DVO (operation directives for the Amateur Radio Service Laws in DL), not necessary.

However, a CW ID will be very useful to notify other hams that an amateur-radio transmission is taking place. All other arrangements regarding the transmission of cards, pictures, schematics, or photos will be in FAX mode, using only a marker pencil and a piece of paper. For "QSL direct" this is the ultimate mode!

Depending on its bandwidth, facsimile is an operating mode which is relatively susceptible to disturbances. This means documents with a high resolution (small size pixels) require a channel free of disturbance for a fault-free transmission. Since at the start of a FAX transmission a synchronization (phasing in) between the machines is being established, short disturbances don't influence the contents of the whole transmission too much. With QRM, however, the transmission of high-resolution documents must be dropped.

Each FAXer holds an assortment of marker pencils with various line thicknesses to adjust the transmission conditions. For example, a callsign which is written with a line thickness of 5 mm or more comes through the highest QRM with proper reading. With selection of a slower drum speed than 120 rpm and an IOC of 576, disturbances also can be bypassed.

A FAX QSO is a very attractive matter. A communication frequently takes longer than an hour. While waiting patiently for the next picture, there is also time for minor repairs or any improvements to the station.

EUROPA FAKSIMILE DIPLOMA, "EU-FAX-D"

The Deutscher Amateur Radio Club (DARC) issues the "Europa Faksimile Diploma (EU-FAX-D)" to promote amateur FAX activities. The award is available to all radio amateurs, club stations, and SWLs. It is based on two-way FAX contacts with different European countries and their prefixes.

1. The EU-FAX-D will be issued in 3 classes: EU-FAX-D 3, EU-FAX-D 2, and EU-FAX-D 1.

2. EU-FAX-D 3: Written confirmations (QSL or FAX prints) from at least 5 different countries (regardless of the band used) and a minimum of 10 prefix points are required. (a) The European countries are determined by the European countries list (WAE list), see below. (b) Each official European prefix counts for one prefix point per each band.

EU-FAX-D 2: 20 prefix points in 10 countries.
EU-FAX-D 1: 40 prefix points in 20 countries.

3. All amateur bands where FAX as a mode of communication is permitted (including VHF) may be used. Only two-way FAX contacts are valid.

4. All QSLs must confirm "two-way FAX" (Faksimile). QSLs shall be dated on or after January, 1980. Any altered or forged confirmation will result in disqualification of the applicant.

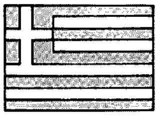
5. FAX contacts during the "DARC-FAX Contest" can be used for EU-FAX-D endorsements, provided the log of the requested station has also been received. Therefore, claims should not be made before the publication of the annual contest results. Requests must be stated within two years after the respective contest.

8. The fees for each certificate are DM 10 or 15 IRCs.

7. Send both a list confirmed by your official radio club and the fees to: DARC FAX Manager, Hans-Juergen Schalk DJ8BT, Hammarskjoeld-Ring 174, D 6000 Frankfurt 50, Federal Republic of Germany.

WAE Countries List

C31, CT1, CT2, DL, EA, EA6, EI, F, FC, G, GD, GI, GJ, GM, GM Shetland, GU, GW, HA, HB, HBØ, HV, I, IS, IT, JW Bear, JW Spitsbergen, JX, LA, LX LZ, OE OH, OHØ, OJØ, OK, ON, OY, OZ, PA, SM, SP, SV, SV5 Rhodes, SV9 Crete, SV Athos, T77/M1, TA European part, TF, UA1346, UA2, UA Franz Josefs Land, UB, UC, UN/UK1N, UO, UP, UQ, UR, Y22-99/DM, YO, YU, ZA, ZB2, 1AØ, 3A, 4U1 Geneva, 4U1 Vienna, 9H1.



GREECE

Manos Darkadakis SV1IW
Box 23051
Athens 11210
Greece

As you probably don't know (but you can take my word for it), Greece has a tradition with respect to VHF and UHF activities taking place in this part of Europe. For some years now, quite a few SV amateurs have supported the European VHF Contest during the first weekend of September. This contest is organized by DARC and offers an excellent opportunity to all VHF enthusiasts to meet again with the challenge of long-distance communications on the high frequencies. The only problem with this kind of contest is that the normal QTH isn't any good; you have to choose another one!

With that in mind, five SV amateurs decided to participate in this year's contest and they chose a location promising good traffic, a spot on a mountain in the northeast part of Peloponnese, 1700 meters above sea level, some 200 km west of Athens (European QTH-locator LY 15 B). So, on the afternoon of August 31, SV1DC, SV1JG, SV1PL, SV1RC, and SV1RL headed up to the new QTH.

Now, since this is not a detailed description of their trip and stay there, I'm going to point out only a few interesting things about this mini-DXpedition. The equipment they carried was an ICOM IC-271, a Yaesu FT-480R, and a Mirage B-1016 P.A. There was also a generator to power up the radios through Yaesu's FP-107 power supply. Antennas were a 19 el and a 9 el made by F9FT. The propagation was not at its best, but within the 24-hour period of the contest they managed to work quite a few stations in every part of Greece and in Bulgaria, Yugoslavia, and Italy.

Some interesting experiments also were carried out on UHF, where contact with Athens was possible even with 100 milliwatts and a rubber ducky from their side. I also would like to mention a test between the preamplifier fitted into the IC-271 and the one inside the B-1016. Though ICOM's preamplifier utilizes a GaAsFET transistor and Mirage's a JFET type, the difference between the two is surprisingly big. The signal-to-noise ratio in weak-signal reception was rather annoying when ICOM's preamp was switched on, and it did not help at all. On the contrary, when the Mirage preamp was switched on, a great improvement in signal-to-noise ratio was obvious, which in effect pulled the weak ones out of the noise. So, hats off to Mirage...

Finally, the team would like to pay a tribute to SV1RC, who was responsible for the food supplies. Spyros at his best loaded his car with 45 steaks and 72 cans of beer. He was responsible for cooking, serving, etc., and he also made sure that the team consumed everything. After the DXpedition was over, the team elected

Left to right: SV1RL, SV1DC, SV1PL, and SV1RC.

The QTH in "Steakland."

Spyros as the king of the new country—named "Steakland." They even intended to send paperwork to ARRL for approval of Steakland as a new DXCC country. What do you think of that?

GREAT BRITAIN

Jeff Maynard G4EJA
10 Churchfields
Widnes WA8 9RP
Cheshire
England

THE UK SCENE

For some time now, European VHF enthusiasts have used a QTH locator system called QRA as a ready means of identifying their station position. It is based on a grid system that arbitrarily divides Europe into a series of major squares.

Each major square is identified by a pair of letters from the horizontal and vertical axis. Each major square is subdivided into one hundred minor squares. Each minor square is further subdivided into 9 final squares. A particular QTH is identified by reference to the final square in which it resides.

My own QTH in Widnes can be identified as QRA YN 47b which locates it to within a few hundred meters. The QRA system has become very popular for two reasons.

First, it enables a ready computation of the distance between any two given stations. Given a QRA locator during a QSO, and knowing your own QRA, it is easy to calculate the direct distance between the stations using a home computer or calculator. Since most VHF/UHF contests award points based on distance worked, this is clearly most useful.

Second, a number of awards are based on "squares worked." In all cases these refer to the major squares. Since some of these contain large areas of sea or little population, it is not easy to collect the quantity required. DXpeditions regularly advertise their impending activation of particularly rare or desirable squares.

The system has worked well for many years. Unfortunately, it suffers from a particular disadvantage. This is that it cannot be extended on a worldwide basis. Indeed, it has proved difficult to extend the system into East Europe as VHF distances worked have increased.

A new system is to be used with effect from 1st January 1985. This is applicable worldwide and, therefore, overcomes the major limitation of the original QRA system. The new locator has a degree of compatibility with QRA from which existing references can be translated. Of particular importance to award hunters is the ready transcription of major squares from one system to the other. The hunter with only one square to collect for a particular wall decoration will not have to start again (much to his relief, I guess).

The new system is based on the division of the world into fields. Each field covers 20° of longitude and 100° of latitude. This gives a total of 324 fields, labeled AA through RR.

Each field is subdivided into 100 squares, 1° in latitude and 2° in longitude, and numbered 00 through 99. Incidentally, each of these squares coincides with a major square of the old QRA system. Hence the basic compatibility (although the nomenclature is quite different—my own YN square is now known as IO83).

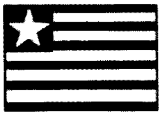
The squares are finally subdivided into a 24 × 24 grid of subsquares, each of 5' longitude by 2.5' of latitude. The subsquares are labeled AA through XX. A full locator is therefore of the form IN79DC.

To enable individuals to calculate their new locator readily, the RSGB has produced a locator map for $2.00. This covers only Western Europe, but the instructions for determining a locator reference are given in no fewer than 17 languages. Clearly, somebody thinks the system will find wide acceptance!

A recent sign of the times is the introduction in the Radio Society of Great Britain's magazine, *Radio Communication*, of a computing column. I think this is basically a good idea. I am very much in favor of expanding general awareness and knowledge of computing (which is my own professional discipline).

However, I do find that some of the programming examples are so simple as to be tedious. It's like a constructional article including comments that components be soldered by introducing a hot iron and solder at the wire/board junction. I worry that too much space will be taken up with coding printouts, when all that should be necessary is a note of the principle or basic algorithm.

King Hussein JY1 and Rune SM0COP.



LIBERIA

Brother Donard Steffes, C.S.C.
EL2AL/WB8HFY
Brothers of the Holy Cross
St. Patrick High School
PO Box 1005
Monrovia
Republic of Liberia

AMATEUR RADIO IN LIBERIA

The Liberia Radio Amateur Association may locate its headquarters in one of the Liberia Telecommunications buildings. That would be somewhat like an American amateur-radio club setting up in an FCC building. In the States, such a move might develop severe complications because of the multitude of amateur clubs. Here in Liberia, we have only one.

Half a dozen years ago, our amateur association was well situated in the Justice Building, at a very convenient location near the center of the city. I was not in Liberia at that time, but I am told that they had a sizeable room with adequate furniture and an operational amateur station with its TA-33 on the roof. The transceiver was an HW-101.

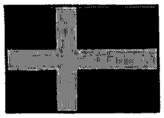
With the change in government, the amateurs lost access to those facilities and to date have not been relocated. The new government did tolerate amateur activities and to my knowledge there was no time when those privileges were denied. For a period of about a year, however, no new calls were issued and no one was quite sure of the future. Over the years the amateurs of Liberia have behaved themselves and have observed the law, and I think that it was in view of this fact that the new government saw fit to allow continued amateur-radio operation.

In any case, life has gone on, and since the association has not been able to find a place to reestablish its headquarters, it has had to hold its meetings wherever space and facilities could be found. Many of the meetings were held in one of the recreation rooms at the Firestone Rubber Plantation, forty miles out of town. Some meetings were held in private homes, and at least one was held at the social center of the American Embassy. The Liberia Radio Amateur Association was fortunate to be in the hands of strong and capable leadership during those difficult times, and it has not only held its own but has gained strength. Right now we have seventy-five amateurs in Liberia (plus or minus a few). In Tappita City, we have six students who are ready for their tests in Morse code and radio theory, and in Buchanan we have a class of 31 in progress. All this time we have been without a central location from which to operate, but now it is possible that within a year we will be given the use of a room in one of the telecom buildings.

The Telecommunications people maintain classroom facilities in order to prepare candidates to work for them. At the present time, they are in the process of relocating their classrooms and the rooms presently in use will be vacated. The building in which these classrooms are located is an ideal site for an amateur-radio headquarters. As one might expect, the space that is becoming available is in great demand, but there is a good chance that the amateurs will get the use of one of the rooms.

During this period of time, the association has retained its call letters, EL2RL. The HW-101 and the TA-33 are still functional. Both have been farmed out for use until such time as we find a new place for them.

An added note of interest: The rainy season wound down to an end October/November, having washed our antennas with 196.5 inches of rain. These gleaming antennas had not served us well for three months. Communication was very poor, probably the fault of the ionosphere. Then signal strength improved. As the dry season came in (with no rain at all), the harmatan would blow in, coat the antennas with dust and, for those of us along the ocean, also a little salt. This kind of conditioning does not contribute to well-functioning antennas!



SWEDEN

Rune Wande SM0COP
Frejavagen 10
S-150 22 Nykvarn
Sweden

JY1 VISITS SWEDEN

His Majesty, King Hussein of Jordan, holder of the well-known amateur-radio call JY1, visited Sweden, together with his family, during three days in October. It was a private visit on invitation by Swedish King Carl XI Gustaf and Queen Silvia. King Hussein also met with representatives for the Swedish government, visited Saab-Scania in Linkoping, manufacturer of automobiles and aircraft, and did some sight-seeing in Stockholm.

Knowing that King Hussein is genuinely interested in ham radio, Ulf SM5BBC and I tried to reach him in the Royal Palace in Stockholm in order to arrange for a greeting from the Swedish hams. Ulf had previously been in contact with JY2RZ, Prince Raad, who together with his Swedish wife also was on this trip. On Friday night, the day before the Royal Family returned to Amman, we were invited to see them in the Royal Palace for what turned out to be a very pleasant and informal meeting among hams. During the hour and a half Ulf, Stig SM0CWC, Ake SM4EAC, and I met with King Hussein, Prince Raad, and Ali JY3AK. We found that our experiences from the DX bands were very much the same. On the question why JY was so rare now compared to a few years ago, the King jokingly told Prince Raad to close down the Amman 2-meter FM repeater for some time when they returned home.

The King had a QSO with Erik SM0AGD on one of the local Stockholm repeaters using Ulf's call as "second operator" JY1/SM5BBC.

Before we left, the charming Queen Noor JY1NH returned from her shopping tour and joined us. She confirmed that although the King has much too little time for ham radio, he really tries to get on the air as often as he has the chance to.

WARC BANDS NOW OPENED

Sweden, together with neighboring Finland and the USSR, has been among the very few countries that have not authorized the WARC bands for amateur use. Early 1984 we got the word from the National Swedish Telecommunication Administration that during the CEPT conference in Madrid, Spain, in April, they were going to ask participating nations about

Frequency kHz	Mode	Power Input	Class of License
10,100–10,150	A1A	150 W	A and B
18,068–18,168	A1A	150 W	A and B
24,890–24,990	A1A	150 W	A and B
24,890–24,990	A1A	100 W	C

Fig. 1.

their experience on the new WARC bands. In October, 1984 we finally got the long-desired information that as of December 1, 1984, the 10-, 18-, and 24-MHz amateur bands would open for Swedish radio amateurs (see Fig. 1).

In accordance with the restrictions put on the Swedish hams on the 160m band, also on these new bands, the following have to be compiled with:

- amateur traffic is permitted on a secondary non-interfering basis
- amateurs are required to listen on the frequency before and during transmissions in order not to interfere with priority traffic
- participation in contests on the WARC bands is not permitted
- permission to use the WARC bands can be withdrawn with immediate effect if objections are filed

We are extremely happy being allowed to join the many amateurs already on these new bands. Although the tough winter weather was upon us, I am sure that very many Swedish hams planned to be out there working on WARC band antenna projects. By the time you read this, you certainly have worked many SM stations on these interesting bands, and I hope to meet you there too.

HAM HELP

I need a diagram for a Sansui model 400 AM/FM stereo. Can anyone help?

M. McDaniel W6FGE
940 Temple St.
San Diego CA 92106

Would someone please help me find a manual for a Hammarlund HQ-170 receiver? I will gladly pay any costs incurred.

Fred Wood WB3JKC
1020 West Lanvale St.
Baltimore MD 21217

Can anyone provide assistance or information in converting the HyGain 3750 to using the 6146 tube?

Also, I desperately need a 19-kHz crystal for the RCA stereo FM signal simulator model WR-52A. I will pay any reasonable price for the information.

Connie Mercer NG4C
403 Pershing Drive
WSMR NM 88002

I am looking for technical data, especially the schematic, covering a Meditron model 302 electromyograph, manufactured by Meditron, a division of Crescent Engineering and Research Co., El Monte CA, which is apparently out of business. I will gladly pay for copying expense and postage. Any MDs out there that can help?

Doug Lyon
11908 Cresson
Norwalk CA 90650

DEALER DIRECTORY

Culver City CA

Jun's Electronics, 3919 Sepulveda Blvd., Culver City CA 90230, 390-8003. Trades 463-1886 San Diego, 827-5732 (Reno NV).

Fontana CA

Complete lines ICOM, DenTron, Ten-Tec, Mirage, Cubic, Lunar, over 4000 electronic products for hobbyist, technician, experimenter. Also CB radio, landmobile. Fontana Electronics, 8628 Sierra Ave., Fontana CA 92335, 822-7710.

San Jose CA

Bay area's newest amateur radio store. New & used amateur radio sales & service. We feature Kenwood, ICOM, Azden, Yaesu, Ten-Tec, Santec & many more. Shaver Radio, Inc., 1775A S. Winchester Blvd., Campbell CA 95008, 370-6665.

New Castle DE

Factory Authorized Dealer! Yaesu, ICOM, Ten-Tec, KDK, Kenwood, AEA, Kantronics, Santec. Full line of accessories. No sales tax in Delaware. One mile off I-95. Delaware Amateur Supply, 71 Meadow Road, New Castle DE 19720, 328-7728.

Preston ID

Ross WB7BYZ has the largest stock of amateur gear in the Intermountain West and the best prices. Call me for all your ham needs. Ross Distributing, 78 So. State, Preston ID 83263, 852-0830.

Littleton MA

The reliable ham store serving NE. Full line of ICOM & Kenwood. Yaesu HTs, Drake, Daiwa, B&W accessories. Curtis & Trac keyers. Larsen, Hustler, Telex/Hy-Gain products. Mirage amps., Astron P.S., Alpha Delta protectors, ARRL & Kantronics instruction aids. Whistler radar detectors. Full line of coax fittings. TEL—COM Electronic Communications, 675 Great Rd. (Rt. 119), Littleton MA 01460, 486-3400/3040.

Derry NH

Serving the ham community with new and used equipment. We stock and service most major lines: AEA, Astron, Azden, B&W, Cushcraft, Hy-Gain, Hustler, ICOM, Kenwood, KLM, Larsen, Mirage, Mosley; books, rotors, cable and connectors. Business hours 9-7 Monday through Thursday, and 9-5 Friday and Saturday. Rivendell, 68 Warner Hill Road, Derry NH 03038; 434-5371.

Albany, New York
UPSTATE NEW YORK

Kenwood, ICOM, Ten-Tec, Belden, Cushcraft, Larsen, Hustler, ARRL, Hy-Gain, B&W, MFJ, Mirage. New and used equipment. Serving the amateur community since 1942. Adirondack Electronics, Inc., 1991 Central Avenue, Albany NY 12205, 456-0203 (one mile west of Northway exit 2W).

Columbus OH

The biggest and best ham store in the Midwest featuring Kenwood and other quality products with working displays. We sell only the best. Authorized Kenwood service. Universal Amateur Radio, Inc., 1280 Aida Dr., Reynoldsburg (Columbus) OH 43068, 866-4267.

Dallas TX

IBM PC/XT kits, supplies, expansion products; video restorer kits for pay TV, CATV, satellite hobbyists' electronic project kits/appnotes. More than 9000 parts in stock: semiconductors, ICs, discretes, video accessories, tools, audio, automotive, cabinets, computer peripherals. Please write for your free 60-page catalog: Sabet Electronics, 13650 Floyd Rd., Ste. 104, Dallas TX 75243; 783-4950 (formerly I.E.).

DEALERS

Your company name and message can contain up to 25 words for as little as $150 yearly (prepaid), or $15 per month (prepaid quarterly). No mention of mail-order business or area code permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the June '85 issue must be in our hands by April 1st. Mail to 73 Magazine, Peterborough NH 03458. ATTN: Nancy Ciampa.

PROPAGATION

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA	20	20						15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40	40		20	15	15	15	15	
SOUTH AFRICA									15	15	15	
U. S. S. R.							20	20				
WEST COAST			80	80	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
SOUTH AFRICA										15	15	20
U. S. S. R.								20	20			

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20	20				15
PHILIPPINES	15							40		20		
PUERTO RICO			20	20	20	20	20	20				15
SOUTH AFRICA										15	15	
U. S. S. R.									20			
EAST COAST		80	80	40	40	40	40	20	20	20		

A = Next higher frequency may also be useful.
B = Difficult circuit this period.

G = Good, F = Fair, P = Poor.

MARCH

SUN	MON	TUE	WED	THU	FRI	SAT
					1 G	2 G
3 F	4 G	5 F	6 P	7 P	8 P	9 P
10 F	11 F-G	12 F-G	13 F-G	14 F-G	15 G	16 G
17 G-F	18 G-F	19 F	20 F	21 F	22 G	23 G
24 G-F / 31 G	25 F	26 F-G	27 G	28 G	29 G	30 G

Issue #295

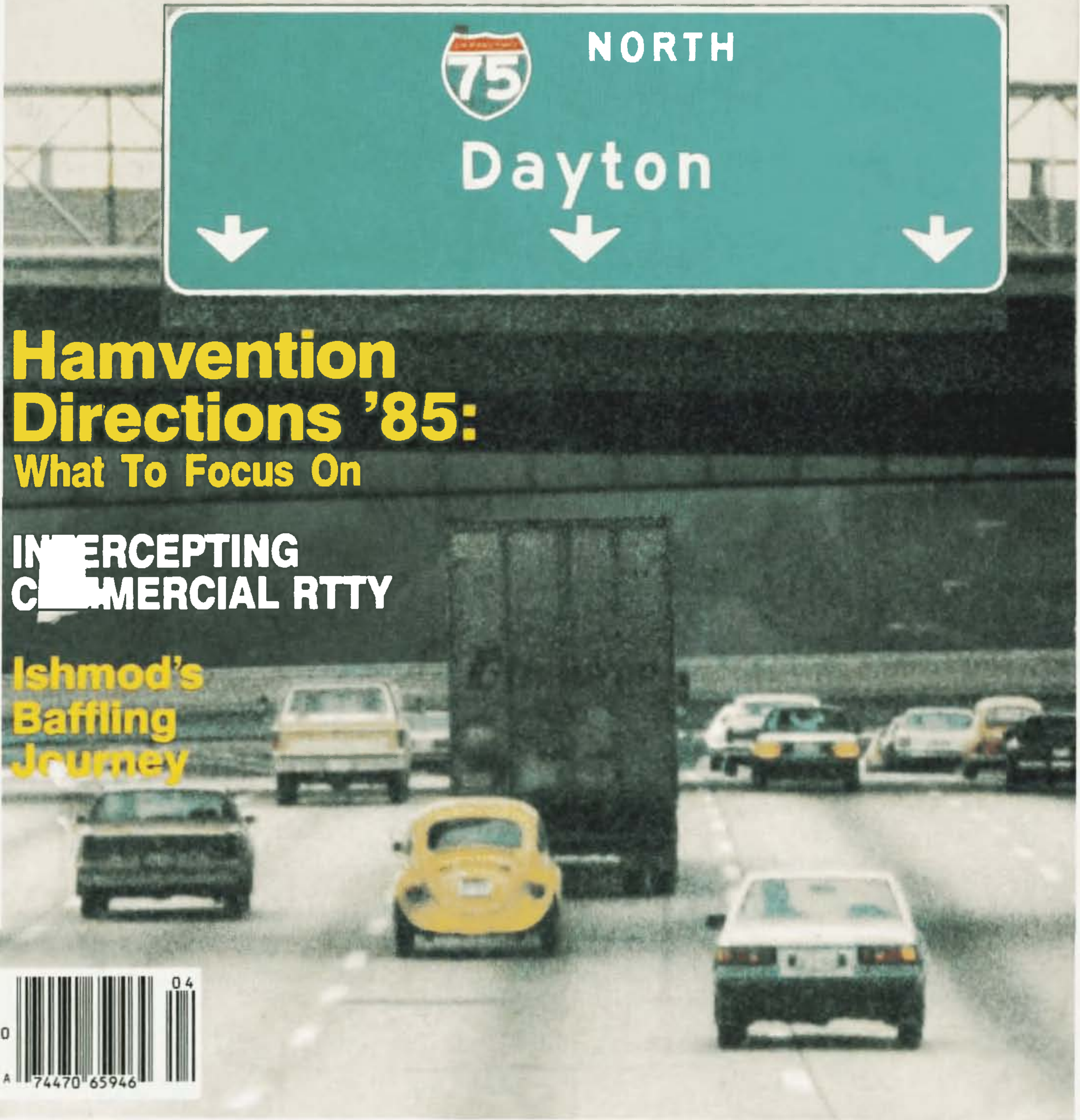
OUR 25th ANNIVERSARY YEAR!

April 1985
$2.50 USA
$3.00 Canada

73 for Radio Amateurs

A CWC/P Publication

International Edition



Hamvention Directions '85: What To Focus On

INTERCEPTING COMMERCIAL RTTY

Ishmod's Baffling Journey

73 for Radio Amateurs®

ISSUE #295 APRIL 1985

On the Cover:
Dayton Directions—Photo courtesy of John Wood WA4BPI.

12 Dateline: Dayton
It's almost here! Take an inside peek at the what, when, and where of ham radio's biggest bash of the year with *73*'s annual Dayton Hamvention sneak preview. WA4BPI

20 Hear, Hear!
Stop settling for second-rate signals from OSCAR. You've really no excuse. W6IOJ's low-noise preamp is easy to build and includes all the circuits necessary for alignment. So do it! W6IOJ

24 Ishmod's Journal
What really happened on that lonely, uncharted rock? And what was the eerie glow? . . . . Whipple

26 Don the Dayton Hat-tenna
Put a cap on your communications problems with a rubber duck that's heads above the rest. WB3CQA

30 Zounds! Grounds!
Here are the down-to-earth details you need to install a perfect ground system. K4IPV

36 Build the Dixie Whistler
Adding two-tone SSB analysis to your test repertoire is as easy as one, two, tweet. WB5IPM

48 In Search Of: RTTY
Experience the mysterious world of RTTY beyond the band edge, but beware! Its allure's too great for all but the stoutest of heart. . . . . WAØMRG

54 Take A Hike
Combine a regulated power supply with a lightweight rechargeable battery. Add a smart control system. The result? Incredible versatility! N3BEK

4 Never Say Die
7 QRX
10 What?
59 Barter 'N' Buy
59, 63 Ham Help
60 Special Events
62 Satellites
64 Fun!
65 Review
66 Letters
68 RTTY Loop
68 Contests
69 New Products
82 DX
84 Be My Guest
86 *73* International
93 List of Advertisers
94 Dealer Directory
94 Propagation

Editorial Offices: Pine Street, Peterborough NH 03458, phone: 603-924-9471. **Advertising Offices:** Elm Street, Peterborough NH 03458, phone: 603-924-7138. **Circulation Offices:** Elm Street, Peterborough NH 03458, phone: 603-924-9471. **Manuscripts:** Contributions in the form of manuscripts with drawings and/or photographs are welcome and will be considered for possible publication. We can assume no responsibility for loss or damage to any material. Please enclose a stamped, self-addressed envelope with each submission. Payment for the use of any unsolicited material will be made upon acceptance. All contributions should be directed to the *73* editorial offices. "How to Write for *73*" guidelines are available upon request. US citizens must include their social security number with submitted manuscripts. **Subscription Information:** Rates: in the United States and Possessions: One Year (12 issues) $24.97; Two Years (24 issues) $38.00; Three Years (36 issues) $53.00. Elsewhere: Canada and Mexico—$27.97/1 year only, U.S. funds. Foreign surface mail—$44.97/1 year only, U.S. funds drawn on U.S. bank. Foreign air mail—please inquire. To subscribe, renew or change an address: Write to Subscription Department, PO Box 931, Farmingdale NY 11737. For renewals and changes of address, include the address label from your most recent issue of *73*. For gift subscriptions, include your name and address as well as those of gift recipients. For questions concerning your subscription and to place subscription orders, please call us toll free at 1-800-645-9559 between 9 am and 5 pm or write to *73*, Subscription Department, PO Box 931, Farmingdale NY 11737. *73 for Radio Amateurs* (ISSN 0745-080X) is published monthly by CW Communications/Peterborough, Inc., 80 Pine Street, Peterborough NH 03458. Second class postage paid at Peterborough NH 03458 and at additional mailing offices. Microfilm Edition—University Microfilm, Ann Arbor MI 48106. Postmaster: Send address changes to *73*, Subscription Services, PO Box 931, Farmingdale NY 11737. Nationally distributed by International Circulation Distributors.

W2NSD/1

NEVER SAY DIE

editorial by Wayne Green

SUED

Ask me how it feels to be sued by multi-billion-dollar organizations. I'm getting to be an expert. Ten years ago AT&T was after me, and now it's CBS!

With large firms like those, one never actually knows the real purpose of the suit. Several members of the press have called CBS to try to find out what's behind this latest attack on Wayne Green, but all they get is either a "no comment" or, more often, no returned call.

The suit has to do with my starting a magazine a few months ago called *Digital Audio*. This has to do with the new compact-disc field, which is just really getting started. CBS, which publishes both *Audio* and *Stereo Review* magazines, the two largest in the hi-fi field, is claiming that the use of the word "audio" in the *Digital Audio* title is irreparably harming their magazine, *Audio*. They claim this will confuse the readers.

Before I went ahead with the name *Digital Audio*, I had the title carefully searched by one of the top copyright law firms in the country and got their assurance that they felt I had no conflicts with it. Since the term "audio" is generic for the field, and since there are and have been several magazines using the word "audio" in their titles for several years without any complaint, there seemed no reasonable potential for legal action.

If CBS is going to try to reserve the word "audio" exclusively for their magazine, one wonders at their lack of diligence in the past. One also wonders if it is really possible to reserve a generic word such as "audio" for a magazine title and retain exclusivity to its use. We're all familiar with *Personal Computing, Popular Computing, and Creative Computing*, as well as *Popular Electronics, Electronics Illustrated, Radio and Electronics*, and so on. Then there's *Modern Photography* and *Popular Photography*.

Is this a case of the CBS lawyers generating work just to justify their salaries, as has been suggested by some of the press? Or is this a case where CBS may feel threatened by Wayne Green preempting a new field, digital audio, which they now recognize as one which will soon grow into the largest aspect of hi-fi? Is it possible that CBS, by virtue of its unlimited funds for pursuing legal attacks on Wayne Green, may be using the courts to try to put Wayne Green out of business and put a nuisance out of the way? Considering the CBS dominance in the hi-fi market, am I fighting an anti-trust battle?

I remember all too well one lawsuit where the other attorney bragged that his organization had spent over a million dollars on the case against me—the $250,000 that one cost damned near sunk me.

Digital Audio is doing well and the field is growing quickly—about 100% per year. In addition to music, compact discs are being used for digital information—for instance, the Library of Congress index is coming out on two compact discs. This will be a priceless resource for small libraries.

Even though I don't see where CBS has a legitimate leg to stand on, their resources are so infinitely beyond mine that I could get crushed, so it's scary. And while our legal system may work okay much of the time, there are plenty of glaring examples of its fallibility. Money can buy injustice.

Will Wayne Green be flattened or bled dry by the CBS behemoth? We'll see.

Continued on page 64

QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, 80 Pine Street, Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

QRX. . .

What Next?

A NEW DXCC COUNTRY has been unearthed by hungry DXers! The ARRL Awards Committee has voted 6-1 to accept the DX Advisory Committee recommendation that **ZC4 UK Sovereign Base Areas** on Cyprus be recognized as a separate country. When the Republic of Cyprus was established by treaty on August 16, 1960, Great Britain retained sovereignty over the Akrotiri and Dhekelia military bases. It's taken twenty-five years for anyone to notice! Submissions for ZC4 will not be accepted before June 1, 1985. ZC4 contacts made before August 16, 1960, will be credited to Cyprus. Unfortunately, all ZC4 contacts made after 1960 were not necessarily with Sovereign Bases. If your card specifically indicates operation from one of the bases, you're in luck. The DXCC desk will try to help in pinpointing the location of other ZC4 stations, and you can submit several cards for possible Sovereign Bases credit. If you already have a Bases card credited to Cyprus, you can resubmit it along with a valid 5B4 QSL and nail both countries in one shot.

Scholars

NINETEEN SCHOLARSHIPS have been announced by **the Foundation for Amateur Radio, Inc.**, a nonprofit organization with headquarters in Washington DC. Licensed amateurs may compete for one or more of these awards if they plan to pursue a full-time course of study beyond high school and are enrolled or have been accepted in an accredited university, college, or technical school. Most of the scholarships require that the applicant hold at least a General-class license. The awards range from $350 to $900, with preference given in some cases to residents of specific areas or students in a particular curriculum. You can obtain complete details about the FAR Scholarship Program by sending a letter or card, postmarked prior to May 31, 1985, to FAR Scholarships, 6903 Rhode Island Avenue, College Park MD 20740.

Go, Barry!

BARRY GOLDWATER K7UGA has introduced two nonbinding resolutions to the Senate relative to discriminatory and unreasonable local restrictions on home-satellite and amateur-radio antennas. Senate Resolution 35 deals with the satellite industry. Senate Resolution 36 urges the FCC to protect amateur-radio licensees against unreasonably restrictive land use and other state and local regulations which would render communications impossible or unreliable.

Chilling Tale

THE FASCINATING STORY of Denise Allen VKØYL has kindly been provided by "*73* International" correspondent Jim Joyce VK3YJ. According to Jim, Denise had her first exposure to amateur radio while working on Willis Island as a weather observer early in 1984. Guided by Graham VK9ZW, the island's Technical Officer, Denise devoured the study guides and code-practice tapes which were parachuted onto the remote island. After leaving Willis, Denise successfully passed the radio-license examination and began to prepare for her twelve-month tour of duty on Macquarie Island. Denise is equipped with a Kenwood TS-120S and will operate all bands (including six meters!) as often as possible. The six-meter gear is a Yaesu FT-680, a Lunar amplifier, and a Werner Wulf four-element beam. QSLs for contacts with VKØYL may be sent via Ken VK3AH at his *Callbook* address. Ken is the editor of *Amateur Radio*, the monthly magazine of the Wireless Institute of Australia, and also took the wonderful photograph of Denise pounding brass.

Denise VKØYL giving her fist a workout.

Map Happy

A NEW MAP of the South Pacific is available, published by the State of Hawaii. The map shows the location, capital, and political status of just about every island in the area. You can receive a free copy by writing to the State of Hawaii Information Office, Department of Planning and Economic Development, PO Box 2359, Honolulu HI 96804.

Auto Chew

IF YOU THOUGHT Doctor DX™ from Advanced Electronic Applications was great, wait until you've tried Doctor QSO™! Doctor DX is, of course, AEA's DX contest simulator for the Commodore 64. Well, Doctor QSO is just what it sounds like—a *rag-chew* simulator. The computer displays a 40-meter transceiver with a digital frequency display. You can change the frequency, volume, power output, and filtering by hitting a key. You can also toggle QRM and QRN in or out (a feature I wish my rig had!). Calling or answering a CQ will net a contact, and you're off! I had a very nice chat with a fellow named Joe in Mississippi who was running an FT-901 that he had just purchased. We talked a bit about the weather and what rigs Joe had before he bought the Yaesu. We talked about antennas. Joe was S3 and fading when we signed, after promising to CU AGN SN. In some ways I really expect to hear Joe again on the bands—it was that realistic. Doctor QSO is also designed to be a Morse trainer. By selecting an option on the start-up menu, the operator can use the keyboard to send CW, and the sent characters are displayed on the screen, giving excellent reinforcement. As an introduction to ham radio, Doctor QSO lets a would-be ham talk with amateurs *without needing to know code*. It's a perfect way to pique someone's interest. I could go on and on, but let me just say that AEA has really outdone themselves this time. Look for a review of Doctor QSO coming soon in *73*.

Bird Watcher

A PAIR OF SOVIET BIRDS are on the bench in Moscow. RS-9 and RS-10 are slated for launch later this year. Both satellites use mode A (two meters to ten meters), and RS-10 will sport mode K. Mode K utilizes a fifteen-meter uplink and a ten-meter downlink. We'll have further details as they become available. Thanks to *Amateur Satellite Report* for this information.

Exam Updates

SEVERAL FCC ACTIONS concerning the Volunteer Examiner Program have occurred recently. A Notice of Proposed Rulemaking, PR Docket 85-21, has been issued in response to a petition by Phil Miller, who requests that the waiting period for retaking an amateur examination be reduced

from 30 to 7 days. Various comments have been received at the FCC proposing alternate waiting periods, including 15 and 26 days. The Commission feels that the waiting period is detrimental to the VE program and would like to delete the section of Part 97 that requires it. Three Orders concerning the program have been declared. First, the requirement to notify the FCC Field Operations Bureau thirty days in advance of an examination has been removed. Also, Volunteer Examiners are no longer required to list their address, license class, and license expiration date in Section II of Form 610. This is in response to a petition from the Dayton Amateur Radio Association that pointed out that the information was redundant and unnecessarily cluttered the form. Finally, the third Order dismisses a petition by Gordon Girth that requested several changes to the VE program, including a 3-region limit for VECs and expanded responsibilities for Advanced-class VEs. According to the Commission, "The petition is moot in part, repetitive in part, and requests several rule changes which are contrary to law. It does not warrant the initiation of a rulemaking proceeding."

CQ Sea Dogs

A RARE OPPORTUNITY to work an English Renaissance sailing ship is scheduled for April, May, and June. The *Godspeed*, a 68-foot vessel built to early seventeenth-century specifications, will carry amateur radio on board during her historic journey from London, England, to Jamestown, Virginia. The original *Godspeed* was one of three square-rigged ships that brought the first permanent English settlers to the New World in the winter of 1606. Current plans call for the *Godspeed* to depart London on April 30 and follow the settlers' six-thousand-mile route, which is expected to take around ten weeks. **Captain George Salley KA4FVB** will head a crew of twelve on this extraordinary journey.

G'Day Mate!

DICK SMITH ELECTRONICS is coming to the United States! Those of you familiar with the international scene will recognize the name as one of the largest and most popular electronics suppliers outside the States. The Sydney, Australia, firm was founded in 1968 by Dick Smith who, among other exploits, floated a fake iceberg into Sydney harbor on April Fool's Day and piloted his helicopter in the first solo round-the-world helicopter flight. Dick Smith Electronics plans to offer its own unique brand of business to the American hams, staffing the stores with electronics experts rather than stuffy salespersons. Dick Smith also supplies very nice screen-printed circuit boards for projects found in magazines such as *73*.

Ops at Fire Service Recognition Day (l to r): Harold Burba N6AXQ, John Kitchens NS6X, Marcy Bisson KG6FY, and Bill Bisson KF6XX.

Live Fire

BIG DOIN'S ARE COMING to Van Nuys, California. On May 11th look for **KF6XX** operating live from Los Angeles Fire Station Number 88, from 1700 to 2200 UTC. It's all part of Fire Service Recognition Day, an annual event designed to promote goodwill between local fire-fighting agencies and the public. KF6XX will operate 15- and 20-meter SSB, and a special QSL certificate will be available.

DX Dream

CLIPPERTON ISLAND will be back on the air early this month if all goes well. An international group made up of sixteen hams, headed by **Kip Edwards W6SZN**, will attempt to activate Clipperton between April 3rd and April 10th. It's been seven years since the island was last heard from. The game plan includes three stations running 24 hours per day on 10 through 160 meters using CW, SSB, and RTTY. The team hopes to be able to work SSB and CW simultaneously on the same band. And, if equipment can be obtained, they will try OSCAR and 6-meter operation. Of course the cost for such an adventure is phenomenal—about $3500 per person. If you would like to help finance the operation, contact The Northern California DX Association, c/o Rusty Epps W6OAT, 948 Kiely Boulevard, Santa Clara CA 95051. If the DXpedition doesn't come about, all contributions will be refunded. QSLs go to YASME, PO Box 2025, Castro Valley CA 94546. Cards received without an SASE will be QSLed via the bureau.

Giggers

THE INTERNATIONAL V/UHF CONFERENCE at this year's Dayton Hamvention will sport a fresh new format:

- The unique Noise Figure Contest will be held at the Hara Arena beginning at 6:00 pm on Friday, April 26th. The Arena will be closed to all other Hamvention activities so that any potential rf interference is avoided. Prizes will be awarded for the best designs from 144 to 2304 MHz.
- Technical forums will commence at 9:00 am on Saturday, April 27th, covering topics such as antennas, propagation, contesting, and dynamic range measurements.
- Antenna gain testing begins at 9:00 am on Sunday, April 28th, on a new range located behind the arena. Certificates will be awarded for the highest gain and best figure of merit and to the winners in the homebrew competition. No forums have been scheduled for Friday, so everyone will be free to explore the giant flea market.

Defense Defense

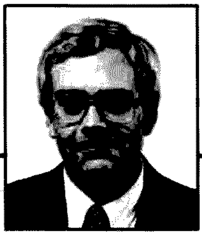
THE DEPARTMENT OF DEFENSE has expressed support of PRB-1, the ARRL request to the FCC for relief from restrictive antenna ordinances. In reply comments to the petition, DoD cited the Grenada action, the Coalinga earthquake, and the 1983 New Orleans flood as examples of the vital need for amateur-radio communications as a backup to federal and civil systems. According to DoD, "Continued success of the existing NSEP (national security and emergency preparedness) telecommunications plans involving amateur stations would be severely diminished if state and local ordinances are allowed to prohibit the construction of and usage of effective amateur transmission facilities."

Perryscope

COMING UP IN MAY is the issue many hams wait all year to receive: our annual **Antenna Extravaganza!** It's stuffed full of practical skywires to build, from UHF to 160 meters. You'll find reviews of antennas on the market and previews of antennas that aren't. And theoretical discussions that you won't be able to put down until the last sentence. On the lighter side, we have a bizarre tale from the Antlers Inn. We'll also show you how to perform a simple appendectomy using common items found in every kitchen! Don't miss the May issue of *73*. If you do, one of our boys will come and stick a pin in your coax.

TNX

SO MANY PEOPLE make QRX a success. This month the news was brought to you courtesy of *the W5YI Report* (electronic edition), the *ARRL Letter*, the *RaRa Rag*, *Amateur Satellite Report*, and all of you wonderful folks who supply your comments and stories. Don't forget to send in your news items, photographs, and ideas to QRX. Or drop by the *73* booth at the Dayton Hamvention . . . a story will buy you a cup of coffee.



WHAT?

News from the Publisher

First of all, thanks to my Florida friends Orson and Doris Hubbard. When I was down there at Tropical-Hamboree time, without micro WP access when I needed it, they lent me your basic Smith-Corona just so I'd have a chance to start cranking this out before I came north. Also, hello to relatively-new Sunshine-State residents Carl and Yvonne Jillson. Their hearts and snow tires still belong to a little town in Vermont called Whitingham, regardless of what they say otherwise.

Second, thank you, Spenser, for coming forth again to share what you know about Ishmod and especially for breaking loose a look at your album.

Third, Miami's Tropical Hamboree at the end of January, one of the four or five best get-togethers in the country every year, should be renamed every year. I propose this right now. *73*'s Perry Donham KW1O and Jim Gray W1XU, who were actually there at the Flagler Dog Track site and reported, concur. 1985's edition should have been called the "Evelyn Gauzens Tropical Hamboree." You shouldn't have to be dead to have a hamfest—of whatever size—dedicated to you. It would be a nice surprise while you're busting your tail helping to put it together. People like Evelyn and Jack Mitchell from Dayton—to name two—deserve a little pre-mortem recognition.

Fourth, I was stunned by a comment made to me in Miami: "Good luck. It must be hard for an outsider from CW Communications to be in charge of *73*." Wrong, wrong, wrong, Chet. My fault, though, for not explaining before just who I am. Here goes: I was born in Albany, New York. I graduated from Columbia High School, East Greenbush, New York. I graduated from Dartmouth College, Hanover, New Hampshire, with separate majors in English and Geography. I've lived for at least two months in Compton CA, Salo SF, Madison WI, York Beach ME, Penn Yan NY, Toulouse FR, and (on) Chappaquiddick Island MA. I saw an ad in the *Boston Globe* in 1974: "Wanted: Marketing Assistant. Good opportunity to learn publishing business." I responded, happened to have an appointment at the right time on a right day, and was hired by Virginia Londner Green on the spot. I started work on November 18, 1974. Since then, I've been Assistant Editor, Managing Editor, and Executive Editor of *73*, as well as Editorial Operations Manager for all of the magazines published by CW Communications/Peterborough. If you have a "Hotline" from the mid-70s or an early issue of *Byte*, you'll find my name on those mastheads, too. Outsider, no. Newcomer, no way. *73* all the way, yes.

Fifth: About our ad rates. You, our readers, probably don't know what our advertisers certainly do, which is that we raised them beginning in January of this year. Next to *QST*, we have the highest. The reason for the increase was that I knew our paper costs would increase dramatically in '85. I wasn't about to kid anyone. I was honest about it, just as some advertisers were frank in suggesting exactly where *73* should be deposited and precisely what should be done with it once there. As we get into this spring and summer advertising-wise, I'm happy to report that more and more people are beginning to realize that they're dealing with an up-front magazine here whose goal is to promote amateur radio and whose readership is characterized (properly) as remaining steady through thick and thin and always being buyer-types. So. . . when you do call a number to inquire or make a purchase, please remember to mention *73*. That goes for when you walk into a store, too. You should also know right now that we don't make crazy advertising deals. When you see an advertiser in *73*, you know that he's paying top dollar to present his product prices to you.

Sixth, see you at Dayton. If you can make it there, please be sure to stop by our booth so that we can get acquainted. If you can't, we'll fill you in via our annual photo report anyway. Look for it in July, if not sooner.

Seventh, our mail is up 14% over last year at this time. Thank you very much. You people are going berserk and I want you to know that I personally love it. We're getting comments and commendations with regards to our 25th Anniversary efforts, as well as recommendations. We're getting constructive and destructive criticism from the USA and offshore; we're getting newspaper and magazine clippings about everything amateur radio is all about; we're getting you name it. No LBs so far. Believe me, everything is read and we do appreciate your input. I can't do this every month, but right now I'm pulling five letters out of the pile (mountain) at random to let people know that there is indeed life after letter-writing and that there is a far-out chance that someday the time they spend to send their thoughts might be recognized. THANK YOU VERY MUCH goes to Ray Beik NH6K (HI), Capt. Robert Conaughty K4OQ (FL), Blaine Hamrick WB5LSJ (TX), Ben Irvine N3CNH (PA), and Gerald Witte K6KMF (CA).

Eighth, I knew I was going to get in trouble last month by mentioning a few of the people who help provide you with *73*. I was right. It's the kind of difficulty that's nice, though, so here's another round:

- Nancy Cook got promoted out of our corporate financial arm to become *73*'s new Publisher's Assistant. If you can't reach me for some reason, please talk with Nancy. Nancy Cook is replacing Nancy Noyd, my long-time friend who retired in December after having spent five years working for *73* and me. I needed someone really smart and really nice and really versatile, so I made the corporate raid to get her. I'm not sorry; she's a super person and superb asset for *73*.
- And then there is Lindy Palmisano, Queen of Typesetters. Nice People—that's all there is to it.
- Welcome to Hope Currier, too, newest member of the *73* team (and another raid made). As Marketing Manager, Hope's biggest job at the beginning will be doing research (i.e., surveys) to make sure that we're bringing our readers and advertisers the kind of magazine that benefits them best. Her second most important task will be trying to figure out how to fit in with people who think that horses and dogs are human, that really good clam chowder is nectar, and that the pun thrives.

Jack Burnett

73 for Radio Amateurs is a member of the CW Communications/Inc. group, the world's largest publisher of computer-related information. The group publishes 52 computer publications in 24 major countries. Nine million people read one or more of the group's publications each month. Members of the group include: Argentina's *Computerworld/Argentina*; Asia's *The Asian Computerworld*; Australia's *Computerworld Australia*, *Australian Micro Computerworld*, *Australian PC World* and *Directories*; Brazil's *DataNews* and *Micro-Mundo*; China's *China Computerworld*; Denmark's *Computerworld/Danmark* and *Micro Verden*; Finland's *Mikro*; France's *Le Monde Informatique*, *Golden* (Apple) and *OPC* (IBM); Germany's *Computerwoche*, *Microcomputerwelt*, *PC Welt*, *Software Markt*, *CW Edition/Seminar*, *Computer Business* and *Commodore Magazine*; Italy's *Computerworld Italia*; Japan's *Computerworld Japan* and *Perso ComWorld*; Mexico's *Computerworld/Mexico* and *CompuMundo*; Netherland's *CW Benelux* and *Micro/Info*; Norway's *Computerworld Norge* and *MikroData*; Saudi Arabia's *Saudi Computerworld*; Spain's *Computerworld/Espana* and *MicroSistemas*; Sweden's *ComputerSweden*, *MikroDatorn*, *Min Hemdator* and *Svenska PC World*; the UK's *Computer Management*, *Computer News and Computer Business Europe*; the US's *Computerworld*, *HOT CoCo*, *InCider*, *Infoworld*, *MacWorld*, *Micro Marketworld*, *PC World*, *RUN*, *73* and *80 Micro*.

John Wood WA4BPI
1101 Little Elton Lane
West Memphis AR 72301

Dateline: Dayton

It's almost here! Take an inside peek at the what, when, and where of ham radio's biggest bash of the year with 73's annual Dayton Hamvention sneak preview.

For the auto-racing buff, Indianapolis is the springtime place to be. For the horse-racing fan, Louisville is the mecca. Amateurs from around the world are no different as they set their sights every April on the midwest target of Dayton, Ohio, and the granddaddy hamfest of them all, the annual Dayton Hamvention.

Over 20,000 ham-radio enthusiasts invaded Dayton in 1984. That many and more are expected to be there April 26, 27, and 28, 1985. But why do so many amateurs turn out for this one event? And if someone wanted to attend, how would he prepare for this trip to ham-radio nirvana? In the next few paragraphs, I will answer these and other questions for you about the hamfest that some hams call "the center of the amateur-radio universe."

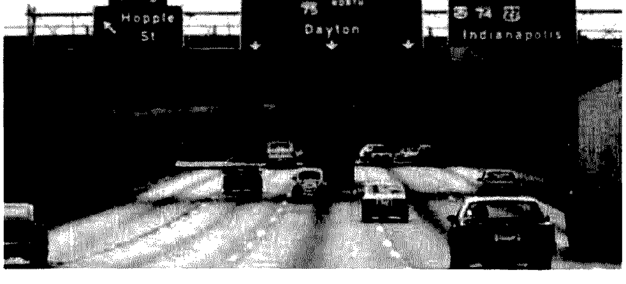
For any business venture to thrive, the first thing it has to have is a great location. That's Dayton's first big advantage. Maybe Dayton is not centrally located geographically, but as far as the population centers are concerned, Dayton is conveniently located. If your home QTH is anywhere in the eastern half of the great USA, you're probably just a day's drive from Dayton.

A second required ingredient for success is good organization, and that's truly an area where the Hamvention shines. Operated as a wing of the Dayton Amateur Radio Association (DARA), all responsibilities for the event are parcelled out to committees that meet the year round. They evaluate the previous year's event in May, study possible changes during the summer months, and by fall everyone knows exactly who is doing what in preparation for the next Hamvention.

Every job is covered. From the job of flea-market chairman, managing over 1,500 spaces available outside, to that of chairman of inside activities, placing over 200 anticipated new-equipment dealers in the right location, all of the responsibilities are assigned. That may seem like an extensive amount of advanced planning, but for a show this big to be produced by volunteers to satisfy the wishes of over 20,000 hams, it's necessary.

Okay, you're impressed by the mechanics, you say, but what can you expect to see and do at the Hamvention? I guarantee you that there is more to see and do at the Hamvention than you'll have time for.

For this and other obvious reasons, it's a good idea to plan how you want to spend your time at the 1985 Hamvention, and the trick is to do your planning as soon as you enter the main doors of Hara Arena where you'll receive your Hamvention program. Take a moment to sit down with the book, see what's on the 1985 schedule, and note the forums and meetings you want to at-



Heading to Dayton? Lots of amateurs are already planning their annual trek to the Ohio city that is fast becoming "the center of the amateur-radio universe."

Hara Arena is the focal point of the Dayton Hamvention, providing room for over 200 indoor displays, daily forums, and the Hamvention's 1,500-space flea market.

As soon as the doors opened on Hamvention 1984, the Hara Arena was filled with busy shoppers looking for that certain piece of dream equipment.

Inside exhibits were popular with the 1984 crowd. This was just one of three large arena areas set aside for the over 200 dealers.

tend. That is no easy task considering that almost every topic related to ham radio is touched upon during the weekend, so feel free to be very selective. Inbetween planned discussions, you can make your sweeps through the flea market and indoor displays and, hopefully, see most of what the Hamvention has to offer.

Just what will you see? In years past, I have found that dealers like to have their newest products debut at the Dayton Hamvention to take advantage of the large crowd of prospective customers. After all, it's a basic advertising axiom that the more people who see your products, the more sales you'll make and the more word-of-mouth advertising you'll generate. When the prototype synthesized HT came on the scene, it made its first public appearance at Dayton—so watch for the new and the unusual.

Besides the newest equipment, you'll also be seeing some of the lowest prices ever offered on amateur-radio gear. You might call it the "Dayton Discount," but I've found prices there to be consistently lower—again because of the large number of buyers, for that can turn small profit margins per item into large total profits.

I can't guarantee that you'll find the lowest possible price on that receiver you've been dreaming about, but I can say that whenever I want to buy something, I shop Dayton first. Yes, I'll pay $22.00 a box for ten floppy disks at my local computer store, but I will also stock up by buying a few boxes at the Dayton flea market where they're going for $16.00 a box; that's just knowing a bargain when you see it and taking advantage of it.

Amateur equipment is not all you'll see at Dayton. During the 1984 Hamvention, I saw a variety of displays, from portable Halon fire extinguishers to recruiters telling amateurs about a career in the Central Intelligence Agency. (But don't ask anyone where the CIA booth is located; it's a secret.)

HINTS

- Secure room reservations for the nights of April 26 and 27, and if you plan to arrive on Thursday, include the night of April 25 in your reservations.
- Get the group together so you'll know who plans to go, then you can figure on how many cars you'll need to make the trip.
- Save money by ordering your registration tickets in advance, and at the same time order your flea-market permits, if needed.
- Talk to the boss and arrange for time off on the appropriate dates—April 26 plus any days needed for travel.
- Save your money to pay for the trip and whatever equipment you've been wanting. Convert most of that money into traveler's checks which are readily accepted by dealers at the Hamvention. Don't expect a dealer to take your personal check.
- If you plan to sell items in the flea market, look around the ham shack for equipment you can bear to part with and put a fair price on it. Then be ready to watch it go when you put it on display at the Hamvention flea market.
- Make and carry a list of things you want to buy while at the Hamvention. You'll be looking at so much equipment, you could forget what you came to Dayton to get!

So there's really no telling what you'll see at the 1985 event. I expect the latest in amateur-radio gear to be on display—from antennas and towers to transmitters and computers—but you might also find a version of an old radio that only your grandfather could remember. It's the diversity that is one of the appeals of Dayton, so keep your eyes open as you wander the aisles. Much of what you'll see can be seen only at Dayton.

Preparations

Now that I have you eager to attend the 1985 Hamvention, you're probably wondering what preparations you should make prior to departure for the amateur-radio heaven known as Dayton. Here's the answer, and be sure you pay attention because it gets kind of complicated.

With part of the show inside and a big part outside at the 1,500-space flea market, you need to be ready for any type of weather Mother Nature happens to have on hand for that last weekend in April. And as any Dayton resident can tell you, the weather can change from year to year and from day to day, from sunshine and 70° F to rain and 40° F with a

possibility of ice, snow, and even wind warnings on area lakes. So be a good scout and be prepared for dressing with the changeable weather in mind.

Start with a short-sleeved shirt and a jacket, and if it gets warm, you can trim down to a T-shirt. But keep the heavy coat and long underwear nearby in case the mercury goes the other way, and always be ready for rain by having an umbrella or raincoat handy. In just the last three years, we've had clear and warm, cold and wet, and, in 1984, simply gorgeous weather. In 1985, the umbrella salesman could become the most popular guy in the flea market—or he could go broke.

GENERAL INFORMATION

- Hamvention information—(513)-433-7720
- Flea-Market Hotline—(513)-223 0923
- Flea-market setup day—Thursday, April 25. Registration tickets and flea-market permits must be shown together for admission to the flea market.
- Deadline for ordering tickets and flea-market permits—April 12.
- Prices—registration tickets: in advance $8.00, at door $10.00; flea-market spaces $17.00; alternative activities $6.00; banquet tickets: in advance $14.00, at door $16.00.
- Talk-In Frequencies: 146.94, DARA repeater. Other available repeaters: 146.31, 224.38, and 224.94.

1985 HAMVENTION OFFICERS

General Chairman—Jack Mitchell AA8Q
Assistant General Chairman—Jim Simpson WB8QZZ
Flea-market Chairman—John Grody WB8TEK
Advance Registration—Paula DiGennaro KA8HQJ
Registration Chairman—Cathy Grody
FCC Testing—Judy Frye KG8P

Flea Market

Speaking of the flea market, the group I go with every year from West Memphis always rents a space or two to sell some extra gear and to serve as a gathering point for the entourage. Why, even some of the hams attending from nearby Memphis know that they're welcome to visit and rest a spell at the West Memphis exhibit. Now that you're planning your trip, you might include the cost of a flea-market space in your Dayton budget.

The spaces are $17.00 this year, up from $15.00 last year, but that pays for use of the space for the entire Hamvention weekend. Even with the slight price increase, the flea-market space is still a great idea for your group—and also a good way to pay or help pay for the trip since you can sell some of your used equipment.

Keep in mind that flea-market permits are available only in advance (four is the limit) and that all spaces are numbered. This change took effect last year and was welcomed by all involved since it allowed the flea-market vendors to set up for the show in advance, eliminating the horrible practice of having flea-market vendors waiting in line overnight for a space—and in some cases waiting two or three days. The ease of setting up last year made for a better Hamvention all around since vendors weren't tired from waiting in line all night and were in more of a mood to bargain. That made for a money-saving situation for the customers. The change was such a success last year that it has been incorporated permanently into the Hamvention plans.

Just remember that if you plan to sell in the flea market, you must order your spaces in advance, and if you order your registration tickets at the same time (at the price of $8.00), you can save money over the at-the-door price of $10.00. So save yourself some time and money and order in advance.

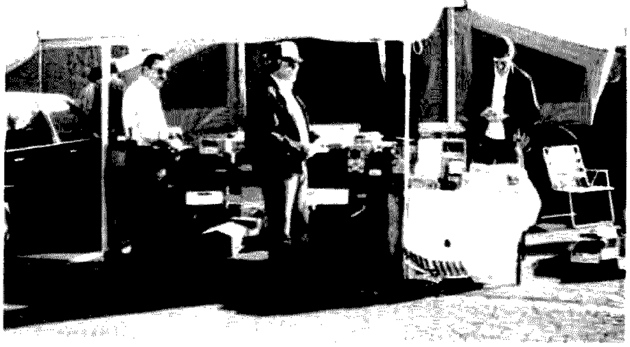
If you have any other questions about the flea market, call the Hamvention Flea-Market Hotline at (513)-223-0923. You might even get to talk to the flea-market chairman, John Grody WB8TEK, or his lovely wife, Cathy, who is the Hamvention's registration chairman.

In a recent interview, Grody asked me to remind Hamvention attendees of flea-market rules: No bikes, roller skates, or motorized skateboards will be allowed in the flea market, and, if a vendor plans to use a gas heater or stove while in the flea market, remember that those devices are potentially dangerous—especially when used in a crowded area—and for their safety and the safety of others, it is a good idea to bring along a dependable fire extinguisher.

Travel Plans

Grody also pointed out that the main section of Interstate 75 through downtown Dayton is going through a two-year recon-

Flea-market vendors and customers fill the aisles in this partial view of the 1984 Hamvention flea market.



Flea-market displays vary with the vendors, but with over 20,000 people attending, the prospective buyer is always at hand during the three-day sale.

struction project, and folks who normally use that north-south artery might want to have an alternate route in mind.

If you are driving around 500 or 600 miles to Dayton with a group of fellow hams and you plan to share the room expenses, you can count on the trip, meals included, costing you about $100. That approximate figure can vary depending on the number in your group, your mode of transportation, and selection of restaurants versus fast-food establishments, but I have found the $100 price tag to be a consistent starting point when it comes to computing expenses. Purchasing a ticket to the annual Hamvention banquet will also change the expense total, but I can tell you from experience that it is money well spent. Going to the banquet was one of the highlights of my 1984 trip to Dayton, so make it if you can.

It's a common sight to see four potential buyers looking over one piece of equipment for sale during the Hamvention.

In the area of securing appropriate accommodations, I can take pleasure in telling you that this sometimes complicated task can be handled easily through the Hamvention's Housing Bureau. If you have a copy of the program from 1984, you'll find an application for 1985 hotel reservations on page 59. If you don't have a copy, write to Dayton Hamvention Housing, 1980 Kettering Tower, Dayton OH 45423-1980. Be sure to get your requests in early.

If you've read this far, I'd say you have a pretty good idea of what Dayton is all about and how to plan for an enjoyable trip to the 34th annual Hamvention. But reading a description can hardly be compared to actually being there and experiencing the event for yourself. It's truly a once-in-a-lifetime experience that I have been lucky enough to enjoy for many years and, I hope, will be lucky enough to continue to enjoy for many years to come. I have no doubt that you'll feel the same way once you attend—and then you'll know why folks who make the Hamvention once go back again and again.

So get the gang together, hop in the car, and head for Dayton, Ohio, April 26, 27, and 28, 1985, to see what's new in ham radio. And if you happen to have the low-band rig in the car, give us a shout on 7.171 MHz. We'll talk about the Hamvention. See you there! ■

John C. Reed W6IOJ
770 La Buena Tierra
Santa Barbara CA 93111

Hear, Hear!

Stop settling for second-rate signals from OSCAR. You've really no excuse. W6IOJ's low-noise preamp is easy to build and includes all the circuits necessary for alignment. So do it!

Operating OSCAR 10 made me appreciate the difficulties one can have in receiving threshold signals in the two-meter band. From my location, and I think it is fairly typical, I can see elevated locations having TV, FM, and aircraft-control transmitters that all saturate my location with high-energy VHF radiation. This is in addition to cable-TV leakage.

Using my original preamp, I received many strange signals in the OSCAR 10 bandpass. The interference varied greatly from time to time, and during some periods it made the receiver inoperative. The greatest offender was the TV station at the receiver image frequency (I could detect the signal with no antenna or preamplifier—simply stray pickup into the double-balanced mixer). There also were many cross-modulation-type signals that I couldn't identify. The old preamp used a typical low-Q input-matching circuit and a fairly sharp tuned-output circuit for discriminating against the mixer image.

This article describes a low-noise preamp that solved my problems. It has a gain of over 20 dB. In addition, the description includes a very handy noise source for tuning up and optimizing receiver performance. It generates power-line-type noise that can be varied in amplitude and keyed. The noise character is such that it can be used with any type receiver, including the SSB/CW receiver. Both assemblies are simple do-it-yourself projects. All parts can be bought from Radio Shack.

Etched PC-board circuitry is avoided in the fabrication by using small PC pads glued to the primary PC mounting board with ordinary household cement. Components are soldered directly to the pad foil for interconnection and support. If a mistake is made, simply lift the pad with a knife and make the necessary change. The method is simple and effective; I found no disadvantages in its use for this particular application.

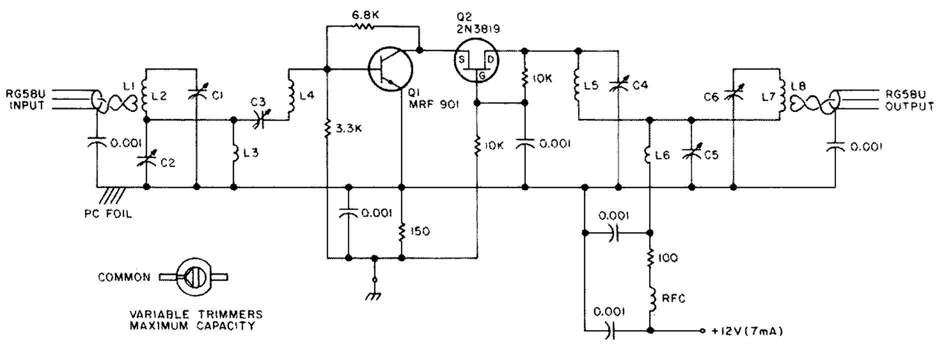


Fig. 1. Schematic diagram of the preamplifier. Numbered components are identified below. Fixed-value resistors are carbon composition, 1/4 W. Fixed-value capacitors are disc ceramic, 50 WV. Numbers in parentheses identify Radio Shack numbers.
C1 through C6—5-60-pF miniature trimmer (272-1340)
Q1—MRF901 (276-2044)
Q2—2N3819 (276-2035)
L2, L4, L5, L7—5 turns no. 14 solid wire, 3/8 inch dia., 7/16 inch long (formed on 1/4-inch-dia. rod)
L3, L6—3 turns no. 14 solid wire, 5/16 inch dia., 1/4 inch long (formed on 3/16-inch-dia. rod)
L1—2 turns no. 24 plastic-insulated stranded hookup wire formed tightly over the end of L2
L8—1 turn no. 24 plastic-insulated stranded hookup wire formed tightly over the end of L7
RFC—approximately 30 turns no. 30 wire on 1/2-W, 1k resistor (two layers)

Preamp Circuit

Choosing the preamp active device becomes easy when you restrict your choice of parts to those which are readily available. The only one that is competitive from the low-noise consideration is the MRF901. Actually, it is not a bad compromise, as the typical noise figure is less than 1.6 at 2m. It has two disadvantages as compared to a good FET: One is that bipolar amplifiers are more subject to overload, and the second is that it is difficult to stabilize

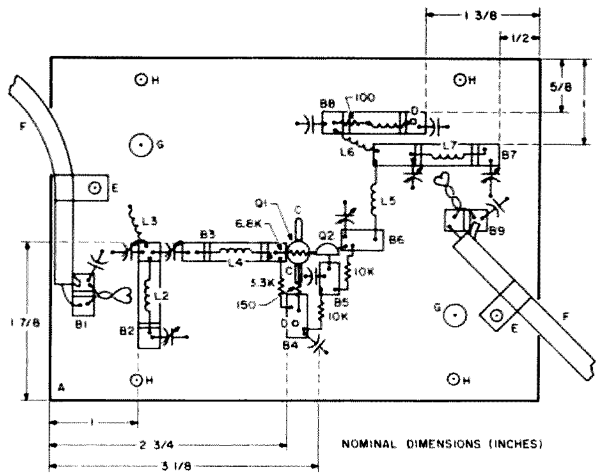


Fig. 2. Layout details.

A—PC mounting board, 4 × 5-3/4 inch, Cu one side

B—Parts-mounting pads, 1/16-inch PC board, Cu either one or both sides (preferably glass insulation). 1/4-inch-wide separate pads formed by filing 1/16-inch-wide grooves to remove Cu. Glued to mounting board with household cement. Length in inches: B1—1/2, B2—1-1/4, B3—1-1/4, B4—1/2, B5—3/8, B6—1/2, B7—1-1/2, B8—1-1/4, B9—1/2.

C—Q1 emitter connections. No. 14 solid wire shaped as tight U, 1/4 inch long, soldered to mounting board.

D—Power-supply connections. Wires connected through holes in the mounting board, reamed on the foil side to prevent shorting of the wire to the PC foil.

E—Cable clamps

F—RG-58/U input-output cables

G—PC-board mounting holes. Require insulated shoulder washers.

H—Shield mounting holes

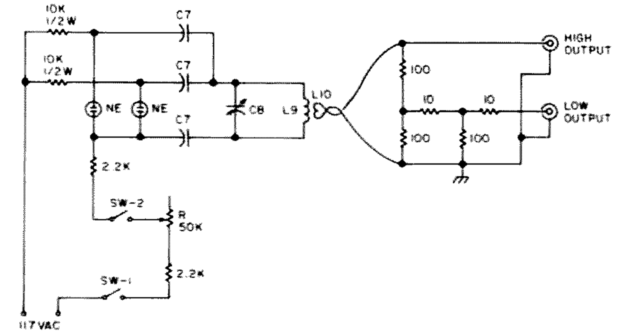


Fig. 3. Schematic of the power-line noise source. Numbered components are identified below. Fixed-value resistors are carbon composition, 1/4 W unless otherwise noted. Numbers in parentheses identify Radio Shack numbers.

R—50k potentiometer (271-1716)

SW1—On-Off switch mounted on R (271-1740)

SW2—Push-to-break switch (275-1548)

NE—Ne-2H neon lamps (272-1102)

C7—0.01 uF, 250 WV (272-1051)

C8—5-60-pF trimmer (272-1340)

L9—6 turns no. 14 solid wire, 3/8 inch dia., 1/2 inch long (formed on 1/4-inch-dia. rod)

L10—2 turns no. 24 plastic-insulated stranded hookup wire (formed tightly over the center turns of L1)

Output connectors—Female BNC chassis type (278-105)

Box—4 × 2-1/8 × 1-5/8 inch (270-239)

when used with narrowband circuitry.

The hybrid cascode circuit shown in Fig. 1 optimizes the MRF901 performance while addressing these potential problems. The cascode 2N3819 FET common-gate second stage accommodates most of the voltage swing, improving the bipolar overload performance. Also, its broadband low-impedance load to the MRF901 reduces the instability tendencies. Stability is further encouraged by connecting the MRF901 emitter leads and all other components referenced to common directly to the PC foil. The one disadvantage of this method is that it becomes necessary to isolate the foil from dc ground when mounting the assembly. The input-output inductive coupling provides the required cabling isolation. Operating current is established mainly by the MRF901 bias voltage. The bias voltage has been set to make a collector current of 7 mA, the maximum current allowable that will maintain an optimum noise figure.

The input filter, while not a particularly good filter when the preamp is trimmed for optimum signal to noise, provides some overload protection to the MRF901. The output filter is a narrowband T network made up of tuned circuits L5-C4 and L7-C6, adjusted for critical coupling by C5. The T-filter low-pass characteristic is discouraged by adding the high-pass inductor, L6; its inductance value is established to not alter the critical coupling value of C5.

Preamp Fabrication

The layout indicating nominal dimensions is shown in Fig. 2. The parts are mounted on the PC board using the glue-down pad technique mentioned earlier. Exceptions to this are the MRF901 emitter and collector connections. The two emitter leads are raised the height of the PC mounting pad thickness using copper pads made from no. 14 solid wire. (This wire is a common house-wiring size and can be purchased at most hardware stores.)

The collector lead is carefully bent upward, the 2N3819 source and 6.8k resistor connections soldered to it without an intermediate connecting method. This avoids possible stray capacitance, a parasitic-oscillation preventive measure. In bending the MRF901 lead, do not apply any stress on the lead-plastic interface (clamp the lead with long-nose pliers at that interface and bend the remaining portion of the lead).

The layout is not critical. First, mount the MRF901; once that is complete, simply glue the mounting pads one at a time while mounting the parts (no need to wait for glue drying). L2-L4 and L5-L7 are mounted at right angles with maximum separation to minimize mutual coupling. The power-supply feedthrough holes in the mounting board require reaming of the copper before gluing B4 and B8 (hand ream with a 1/4-inch drill). Means of mounting the board without shorting the foil to power-supply ground is required. Two holes having fiber shoulder washers are used for that purpose.

Noise-Source Circuit and Fabrication

The noise source makes use of the noise generated from a gaseous discharge, in this case Ne-2H neon bulbs. At the receiver output it sounds identical to power-line noise. Referring to the circuit diagram, Fig. 3, two Ne-2H neon bulbs are powered directly by 117 V ac

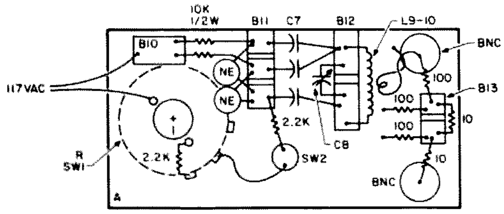


Fig. 4. Power-line noise-source layout details.
A—PC mounting board, 3-1/2 × 1-3/4 inch, Cu one side
B—Parts mounting pads, 1/16-inch PC board, Cu either one or both sides, 1/4-inch-wide separate pads formed by filing 1/16-inch-wide grooves to remove Cu. Glued to mounting board with household cement. Length in inches: B10—1/2, B11—3/4, B12—1, B13—1/2.

through current-limiting resistors. The circuit includes a potentiometer to vary the current/noise output and a push-button switch (normally on) to manually switch the bulbs. A tuned circuit is used for coupling out the 146-MHz noise component. Blocking capacitors completely isolate the ac line from the output circuitry. The link-coupling output provides a direct-connected high output and a second low output through a 16-dB pad. The low output is close to a threshold signal (approximately 6 dB above receiver noise with minimum R) and the pad ensures a 50-Ohm source impedance.

The fabrication method is identical to that used in the preamp. The detailed layout is indicated in Fig. 5. The circuit board is held into the mounting-box faceplate by the panel parts (BNC connectors, SW2, and R1).

Alignment—Operation

The amplifier is completely stable without the shield; leave it off. Start by setting C1, C3, C4, and C6 at minimum, C2 mid-range, and C5 maximum capacity (note capacitor inset, Fig. 1). Connect the noise-source high output to the preamp, and first trim C4 and C6, followed by C1 and C3 for maximum output. Next connect the preamp to the low-noise output and juggle C1, C2, and C3 for optimum S/N. During this final alignment keep your finger on SW2, switching the noise source on and off while making the adjustments. Considering the output filter, I found that not much is lost by leaving C5 at maximum capacity, possibly a 10% gain increase by juggling C4, C5, and C6. Selectivity will be degraded if the capacity of C5 is less than required for critical coupling.

My preamp measured 26-dB gain. However, the gain will vary depending upon the characteristics of Q1 and Q2. I have had no problems with the MRF901. It's a consistent performer and it will take a lot of abuse. I have found inconsistent performance with the Radio Shack 2N3919s. If your amplifier gain is low or if there is some evidence that the stage is contributing to the noise, try another transistor. As a simple test for this, turn the noise source off (leave the cable connected) and then short the C1-L2 junction to the mounting-board foil. The noise should decrease at least 6 dB.

Some will raise their eyebrows looking at a bipolar circuit and an input filter, but the consequences are small. I have had no trouble receiving OSCAR 10 signals, even with the bird on the horizon. My antenna is a home-built four-element yagi with no cross polarization.■

Spenser Whipple, Jr.
c/o 73

Ishmod's Journal

What really happened on that lonely, uncharted rock? And what was the eerie glow?

In April of 1984, we presented (or at least tried to present) the story of Ishmod's Journal. As though still troubled by some unseen force, the story ran afoul of production problems and was abruptly abbreviated in its presentation. It was to be continued on a subsequent page, and to this day some of us don't know what happened.

Last April, when we saw the printer's proofs we were dumbfounded. Concern and curiosity turned into rage; fingers were pointed, the telephones were glued to our ears. We had no time to lay out the issue again, and besides, we couldn't find the missing galleys. Then there was the problem with the errant reference to a nonexistent page. Typesetting had a mysterious glitch that wiped out not only the Ishmod file but also our on-line author information. The hard copy provided by author Spenser Whipple was not in the folder, and Whipple was out of the country again.

We swallowed hard and figured we could reconstruct the missing material and get it into an upcoming issue. Well, it's taken a year. Like the journal itself, the telling of this story also seems to invite the unexpected and unexplained. We hope that with this effort Ishmod's story and its impact on mankind will be at last understood. The story begins with the last (and unfinished) sentence on page 65 of the April, 1984, issue.—Eds.

The rocks of the island exhibited the incredible capacity to alter the infundibuliform. . . I'll try to explain.

Once the five DXpeditioners left the calm water of Chatrapur on the morning of June 25, their main task was to convince the captain of the chartered boat to follow Ishmod's directions. The captain had sailed these waters for nearly 40 years and couldn't accept the fact that there was any piece of land waiting at the coordinates on the crude map laid out before him. Still, Ishmod and the others *had* managed to scrape together the fare that had been settled on after considerable haggling. The captain would indulge their foolish pursuit because he was being paid to do so. The day loomed bright and promising. Ishmod double-checked his fixes and assured the captain that they were on course.

Once underway and clear of the rocks and shoals near land, a battery-powered all-band portable radio was unpacked. If they were going to spend a week on the air, they hoped band conditions would be optimum. The odd thing was that the longer they traveled, the stronger band conditions seemed to get—not just the lower frequencies but across the entire spectrum. No matter where they tuned there was activity, and all this on a short telescoping whip. They

figured they were in for some great operating. Little did they know what they really had waiting for them.

Ishmod figured that they would make land about noon. At 11:30 Dinpoor and Navi began to scan the horizon with borrowed binoculars. By 12:30, all were a little worried. And then they saw it; in fact, they had almost rammed it. Ishmod and the others were all pointing. The captain cursed, jammed the boat's throttle into reverse, and flicked at his stubble, unable to believe what he saw.

They made their approach on the southern or leeward side and glided up to an uncharted, solid-rock island in the Bay of Bengal. They scrambled up the rocks with a whoop. Ishmod took four sightings on the stable footing, made his calculations, and proclaimed their triumph. The captain yelled to them to get their gear unloaded so he could get back before dark. Ishmod went over a copy of the chart with the captain while the others carried their equipment and supplies ashore. The captain told them to be ready one week from the day. If the weather was bad, he'd be there the following day. Soon, Ishmod, Putra, Hator, Dinpoor, and Navi were quite alone.

Using his crude map, Ishmod began to walk the island, his friends chattering along behind him. They all thought they'd check out their new home before setting up the two base camps at the extreme ends of the kilometer-long monolith. There appeared to be no vegetation except for the marine growth near the water's edge, and there was little of that. Although it would matter a great deal later on, no one seemed to notice the lack of fish, crabs, or barnacles near the shore. Luckily, they had planned for the worst and had brought along plenty of fresh water.

There were several things about the island that struck Ishmod as odd, yet in his enthusiasm he had brushed them aside. The island appeared to be solid rock, worn smooth, he supposed, by the action of water and the grains of sand suspended in it. There were some rather curious depressions at about the midpoint of the island, trailing off to the water in the north. The rock of which the island was composed had a definite metallic sheen when the sun struck it just right. In fact, as they walked, the island seemed to blend into the surrounding water, which perhaps could have accounted for the island's lack of visibility. According to the oceanographic reference he'd carried with him, they had arrived at nearly high tide and still had about a meter and a half between their feet and the water. Unless there were to be a storm they'd be dry, he thought.

It took about two hours to make their way around the entire island and return to where they'd left their supplies and radio equipment. Navi turned on the portable radio again to check conditions. The bands seemed strangely quiet now. The only signal he could copy at all was a maritime mobile. The freighter was about 1000 miles off the western coast of South America on its way to Easter Island.

They divided up the radio equipment, wire antennas, tents, sleeping bags, and food and water. Dinpoor and Navi would set up the 40- and 80-meter station at camp 1 at the east end of the island. Hator and Putra would set up the 20-meter station at camp 2 on the west end. Ishmod planned on rotating between the two as needed, although he would sleep in Hator's large tent. Setting up the camps did not go well. Dragging the gasoline-powered generators to opposite ends of the island was very difficult and many trips had to be made. The tent pegs were worthless. They couldn't be driven into solid rock. Finally, by using some of their supplies stacked at the corners of the tents, they managed to at least make some shelter.

It was very dark before they could stop to have some supper and talk about the beginning of their adventure. With the gasoline generator running in the background and with the light of a single camp lantern, the five decided to tune the bands just once before splitting up and getting some sleep. They turned on the Hammarlund HQ-170 they'd been lent from the radio club at the university and began to scan across the 75-meter band.

While their modest antenna consisted only of a dipole suspended about 4 meters above the island's surface by primitive wooden tripods, they had expected more than the dead quiet that greeted them. Navi went out to check the ground connection to the length of copper wire they'd thrown into the water. He tightened the wing nut another half turn and started back to the tent. Off to the north he thought he could detect a faint silvery glow, but it seemed to fade the longer he looked at it.

Back inside the tent, as Putra slowly rotated the main tuning dial, they heard first one voice and then another answering; both were speaking in what sounded like Slavic. Then almost together they realized that the voices they heard seemed not to be coming from the speaker in the tent but from

Continued on page 225

James Yex WB3CQA
PO Box 566
Irwin PA 15642

Don the Dayton Hat-tenna

Put a cap on your communication problems with a rubber duck that's heads above the rest.

Your HT and mine probably have a few things in common. For one, there is the belt clip, either on the HT or its leather case. Its purpose, of course, is to leave your hands free for more important things like scrounging through goodies at a hamfest or when using a speaker-mike. Very convenient.

Another common item is the ever-present rubber ducky. Its compact design is a natural for the HT. With the HT on your belt, however, the antenna location can make it very difficult to hear others and be heard yourself. Very INconvenient! Many of us have utilized the popular Statue-of-Liberty mode of operation in a last ditch effort to pull in that weak signal or make ourselves heard on that distant repeater.

A couple of years ago, while at the Dayton Hamvention, the need for a practical solution to this problem became quite apparent. Ed WB3LHG, my good friend and co-hatcher of strange ideas, had fabricated a quarter-wave whip using stainless steel wire and a BNC connector. When used on the hand-held it was very effective both as an antenna and as a means of clearing a path through the crowded aisles. (If you've ever taken a stroll through the Hara Arena during the hamfest, you'll get my point!)

During an exchange of ideas, we saw a few people wearing hardhats, presumably to protect them from the sun or rain—it *has* been known to rain at Dayton! These were similar to the safety hats worn by construction workers except for one important difference. On top of the hat, seeming to tower above everyone and everything, was a rubber ducky! A great idea, but we decided it might be a little too uncomfortable. Besides, I didn't think hardhats were too easy to come by.

The logical alternative was to change from a hardhat to a soft cap, and after a little experimenting, I went ahead with that.

I found that the antenna could be supported easily by using brass shim stock as a base to which could be soldered a BNC connector. This also served as an effective ground plane. Punching a 3/8" hole where the two

Photo A. WB3LHG putting a Hat-tenna through its paces.

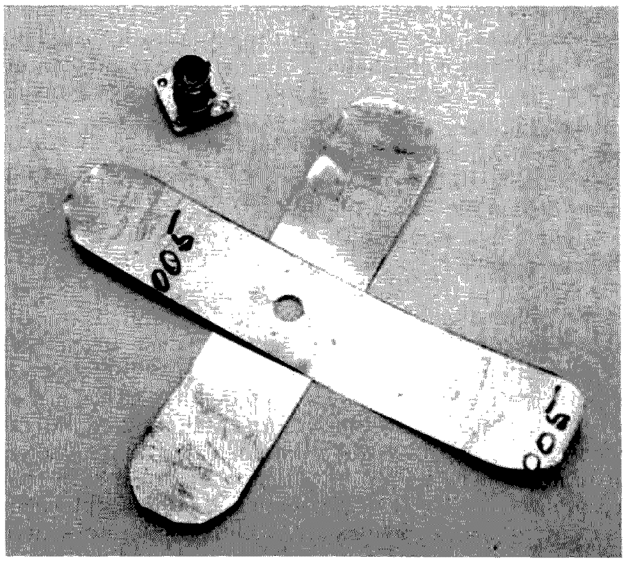


Photo B. Strips of shim stock before attachment of the BNC connector. Hat size will determine the length of the strips.

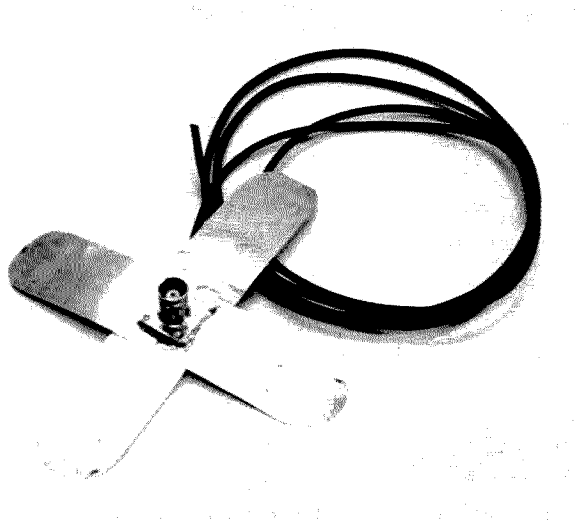


Photo C. Connector and strip assembly ready to be placed inside of the hat. Be sure the coax can reach at least to waist level.

Photo D. Fitting the shim stock under the lining of the hat. A piece of fabric or cloth tape can be placed over the exposed area.

strips form an X provided access to the center conductor. The cable I used is RG-174. It's more flexible than heavier cable, and its small size makes it perfect for this application.

Some patience is needed when installing the ground plane/connector assembly inside the hat. By carefully cutting the lining with a razor, the shim stock can be inserted behind the lining of the hat. Determine where the BNC connector will come through the top of the hat, and cut a small, neat hole accordingly. The coax is also fed through the lining to the rear of the hat where it exits to drop down to your HT; it can be coiled up inside the hat when not in use.

Comparisons between the Hat-tenna and rubber duckies mounted on the HT show a noticeable improvement in performance. ■

Joseph J. Carr K4IPV
5440 South 8th Road
Arlington VA 22204

Zounds! Grounds!

Here are the down-to-earth details you need to install a perfect ground system.

Every book on longwire or vertical antennas stresses the need for a good ground. If you have ever tried to make an end-fed longwire work without a good ground, then you understand why it is so important. We are also told in countless books and articles that a good ground is necessary to prevent TVI and protect against lightning. What is left unsaid, perhaps assumed to be universal common knowledge, is what constitutes a "good" ground. More pertinent to most amateurs, perhaps, is *how* do we obtain a good ground? For most amateurs, the answer is easy to achieve.

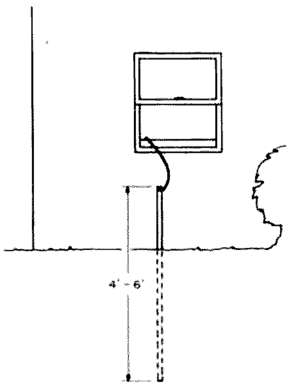


Fig. 1. An ungood ground.

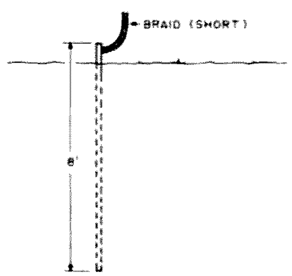


Fig. 2(a). The best ground.

What Is Not Adequate?

One way of defining an adequate ground is to describe situations that are not adequate. Some amateurs try to use the third-wire ground of the ac power line serving their shack as an rf ground. After all, it *is* grounded, isn't it? Well, that depends on what we mean by grounded. That third wire in the power system may be many wavelengths from the point where it is connected to earth ground. To dc and low-frequency ac (e.g., 60 Hz), such a wire is, indeed, low resistance. But to rf, such a long ground wire is a high impedance, so it may be no ground at all!

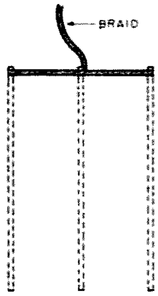


Fig. 2(b). Three ground rods connected in parallel.

In addition to high impedance, there is also the possibility that wire and screw-terminal connections in the system are corroded. Unfortunately, corroded connections are often electrically nonlinear, and that can produce harmonics (TVI!). The power main, therefore, is not good for rf use.

Another form of ungood ground is shown in Fig. 1. I know an amateur who used a 4-foot ground rod driven only halfway into the soil outside his window. Thus, only 2 feet of rod were buried. There are at least two problems with this system. First, the ground rod was buried only halfway into the earth. Second, the darn ground rod was too short in the first place. The 4-foot size is always too short, and a 6-foot rod is considered marginal. The best is the 8-foot size, driven into the ground so that only 4 to 6 inches show, as seen in Fig. 2(a).

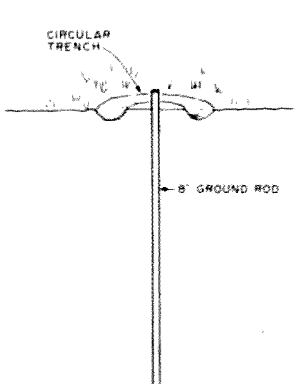


Fig. 3. A method for improving ground-rod effectiveness in very dry or sandy soil.

The wire lead between your equipment and the buried ground rod should be low inductance. For this reason, small-diameter wire is not suitable. Perhaps best is braid wire, or, if braid is too expensive, use the shield from a length of heavy coax (e.g., RG-8 or RG-11). In either event, the wire between the equipment and the ground should be as short as possible.

The electrical connection between the ground rod and the wire must be competent both electrically and mechanically. It should go without saying that a good electrical connection is first a good mechanical connection. For this reason, I prefer to both sweat-solder the braid and clamp it to the ground rod. The clamps that come on the ground rod are marginal, so I use the kind that electricians use. The big problem with the regular clamps is that they are fastened with only a slot-head screw, and they tend to work loose after a while.

The main idea in building a good ground system

is to reduce the impedance as much as possible. The resistive component of this impedance is mostly the resistance between the ground rod and the earth. Therefore, the biggest improvement comes from increasing the surface area of the ground rod that is in contact with the earth. This is the main reason why we want the ground rod to be driven in all the way and its length to be 8 feet.

A way to increase the surface area in contact with the earth is to use more than one ground rod. Fig. 2(b) shows three ground rods connected in parallel; I have seen as many as six in one system. A method shown in a book on lightning protection uses five arranged with four on the corners of a square and one in the center of the square.

The 8-foot ground-rod length assumes a reasonably moist soil (even though the surface may be dry). If the soil is very dry or if it is sandy, then some other tactic will be necessary. A method advocated for many decades in ARRL and other amateur publications is shown in Fig. 3. The idea is to dig a 6- to 8-inch-deep trench around the ground rod at a radius of 1 foot or so. The trench is filled with a chemical such as copper sulphate and re-covered. The chemical leaches into the soil and reduces its electrical resistance. The chemical must be renewed every several years.

Another high-surface-area, low-resistance ground is shown in Fig. 4. Here we see a 1-inch-diameter (or larger) copper plumbing pipe used as a ground rod. These pipes normally come in 8-foot and 10-foot lengths. Unfortunately, copper pipes do not survive the pounding required to drive them into the earth. Ordinary ground rods are not actually all copper, but are steel with a copper coating on the outside to reduce the rf resistance. The well-known "skin effect" makes the rf current flow only in or near this low-resistance copper coating, and very little flows in the steel core. The steel core, then, can be used for strength.

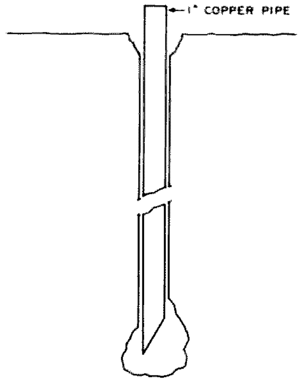


Fig. 4. Copper pipe used as a ground rod.

The 1-inch (or larger) copper pipe will yield greater surface area in contact with the earth (and if we do it right, even the inside will be in contact with the earth) and so should yield a lower-resistance ground. The problem is, however, that the copper pipe is not strong enough to be driven into the ground.

Two people gave me ideas concerning this problem. One was a man at our church who said he used to use a garden hose and water pressure to drive the pipe into the earth, as shown in Fig. 5(a). The end of the pipe is beveled slightly, and then the water hose nozzle is inserted into the upper end. This connection must be held tightly by hand in order to build up water pressure in the pipe. By applying a downward mechanical pressure on the pipe while the water is applying its pressure to drive soil out from under the beveled point, the pipe will sink into the earth rather easily.

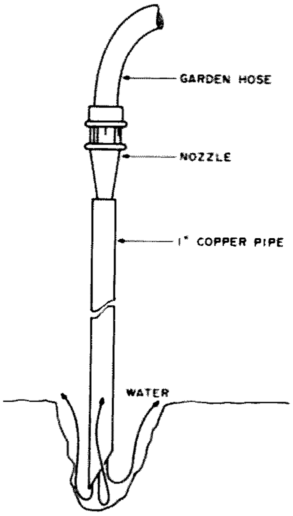


Fig. 5(a). One method of driving copper pipe into the earth.

During the period when I was writing a monthly column for *Worldradio* newspaper, I discussed this method and used illustrations similar to Figs. 4 and 5(a). A reader wrote in and told me that he has been using that method for many decades of hamming and has improved on it a bit. He demonstrated by drawing the method shown in Fig. 5(b). Here we see a copper tee connector at the top end of the ground pipe. A short (6-inch or so) piece of matching copper pipe is extended out one end of the tee and capped to prevent the leakage of water (sweat-soldering is probably necessary). The

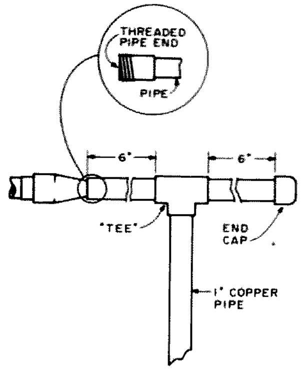


Fig. 5(b). Improved method for driving copper pipe into the earth.

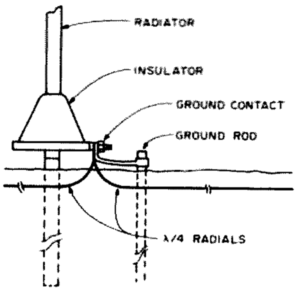


Fig. 6. Grounding a vertical.

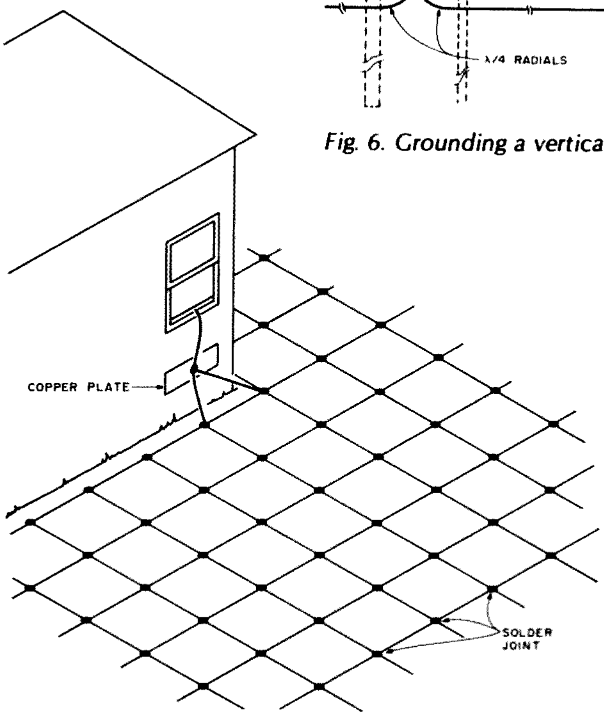


Fig. 7. Wire mesh ground system.

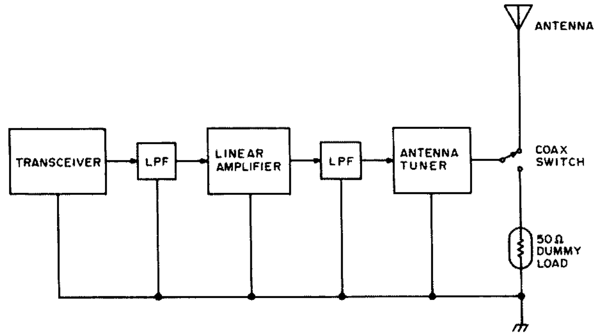


Fig. 8(a). Block diagram of my station.

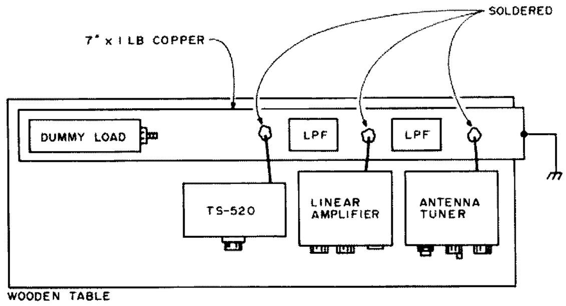


Fig. 8(b). Physical layout of my station.

other end of the tee also has a short piece of matching copper pipe, but this one is uncapped in order to accept the hose. The purpose of this method is to use the short pieces of pipe from the tee as handles to apply the downward force necessary to drive the copper pipe into the earth.

An alternative method shown by my correspondent is shown in Fig. 5(b) as an inset. It seems that plumbing supply and hardware stores sell faucet nipples that can be sweated onto the end of the copper extension piece. This would allow you to directly connect an ordinary garden hose (with the regular nozzle removed), thus making the job a lot less messy.

If you use a real faucet instead of just the threaded nipple as my correspondent suggested, then you would have a means of easily turning the water on and off. The assembly would look a little weird, but it would get the job done!

The ham who wrote to me at *Worldradio* sent a couple of Polaroid pictures of him using his rig, but they were of too poor quality to even attempt reproduction in the magazine. From the pictures, though, it appears that he used the faucet method. The threading on the faucet matches the threading on the hose coupling (after the nozzle is removed!), so the hose will be easy to attach. After the pipe is sunk into the ground, remove the tee coupling and save it for another day.

A vertical is another antenna that requires a good low-impedance ground. All too many people who attempt to ground-mount a vertical antenna will use the mounting pipe as a ground; that's a no-no. That pipe is usually only 2 or 3 feet long and is not a very good ground (galvanized steel).

Fig. 6 shows a method for grounding a vertical. Adjacent to the antenna is an 8-foot ground rod which is connected to the ground terminal of the vertical through a short piece of braid or very heavy wire. Some people also like to use resonant quarter-wavelength radials (2 to 4 per band, or more) connected to the ground point. The radials can be either buried or above ground (although on city lots the buried variety might be safer!). The radials should be quarter-wavelength (i.e., $L_{ft} = 492/F_{MHz}$).

The radials form an artificial ground plane, or counterpoise ground, and so may be used with a variety of antennas which require a good ground. Take the longwire, for example. An endfed longwire is at least a quarter wavelength on the lowest band it serves. The exact length is not critical because the longwire is not resonant. An antenna tuner (e.g., an L-section coupler) matches the high impedance of the antenna to the (usually) low impedance of the transmission line. Almost invariably, discussions of the longwire tell us that a good ground is needed (often without discussing what constitutes a good ground!). As one who had tried to operate longwires in the absence of a good ground, I can confirm that fine advice.

Unfortunately, the very factors which lead us to using a longwire also prevent us from obtaining a good ground for the longwire! A second-floor ham shack, for example, almost never allows a good ground because the ground line is too long. Another example is temporary and/or portable operation. In these cases, using two or more resonant quarter-wavelength radials will work wonders. When we first moved into our home, we had left all of our money with the real-estate-settlement attorney, and none was left for antennas. I was able to get on 15 meters by mounting a Hustler® mobile antenna and two radials in a second-floor window. Only occasionally, when the band was crowded, was I disappointed with the signal report.

Fig. 7 shows the ground system used by an oldtimer I knew many years ago. Abe was originally licensed in the 20s when, he claimed, the ground would make or break an antenna system. When he bought his new house, Abe went out before the sod was laid down and constructed the wire mesh shown in Fig. 7. The wires were laid down about 2 feet apart, and each cross-joint was soldered with 2%-silver lead-tin solder. After the wire mesh was in place, the sod company buried it under a layer of sod grass.

My Ground

A couple years ago, the shack at K4IPV literally became a shack: an 8′ × 16′ Leonard shed in the backyard. After the shed was installed, I set about making my first ground-floor ham station. Figs. 8(a) and 8(b) show the equipment configuration.

My station has the usual lineup of equipment: transceiver, kilowatt linear, and antenna coupler. The coupler, by the way, is a coax-to-coax type and is used less for impedance matching than for additional attenuation of harmonics. The low-pass filter (LPF) between the transceiver and linear is used to reduce harmonics as much as possible before amplifying them in the linear. I have seen some amateurs use a low-power antenna coupler (e.g., a Drake MN-4) in this position.

The physical layout is shown in Fig. 8(b). The operating desk consists of a door made into a table. Along the back edge of the table is a copper strip. Sheet copper is specified by width and weight. The 1 pound/ft^2 weight is both acceptable and easy to work. Copper flashing used

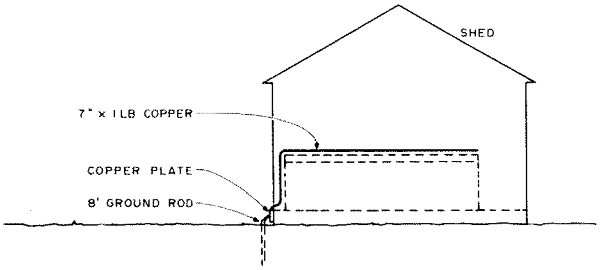


Fig. 9(a). Method of bringing the copper flashing outside.

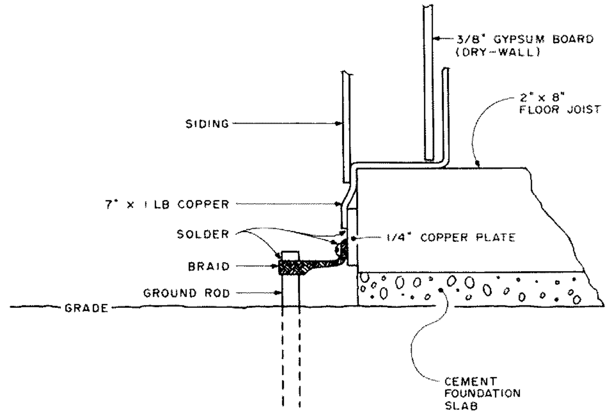


Fig. 9(b). Details of the flashing and copper plate junction.

to be available at all construction supply stores, but aluminum has taken its place. Copper is now found at specialty metal distributors. Each piece of equipment is connected to the copper sheet by short pieces of braid salvaged from RG-8 (or RG-11) coaxial cable.

Fig. 9(a) shows how the copper flashing was then brought outside. The shed uses metal skin, which is loosened by removing sheet-metal screws. The copper flashing was passed under the skin and then both bolted and soldered to a 1/4-inch copper plate. Fig. 9(b) shows the detail of the junction between the flashing and the copper plate.

Soldering to this system can be a bit torturous. I suppose that an old-fashioned 500-Watt soldering iron would do the trick. In my case, however, a 200-Watt soldering gun was the biggest available and it was insufficient. I instead used a propane torch with the Bernz-o-matic soldering tip. The solder was solid plumber's solder with paste flux. *Warning*: use *only* solid solder with resin paste or a heavy grade of resin-core solder. Some plumber's solder or paste is acid based, and that is a super no-no! Acid-core solder, or acid-based soldering flux, will *corrode the joints*.

The connection to ground consists of one 8-foot ground rod and four 6-foot ground rods driven (with two weekends of hard work) into hard Virginia red-clay soil. These rods are connected in parallel with each other at the 1/4-inch copper plate. Again, very short leads are used.

The term "very short" keeps popping up when discussing ground systems. Just what does "very short" mean? Is something which is very short at 80 meters also very short at 10 meters? Not necessarily, because very short is a relative term comparing a wire length to wavelength. In general, very short means "a small fraction of a wavelength." Typically, a length should be less than 1/8 wavelength. Obviously, a ground wire that is very short at 10 meters is also very short at 80 meters. Yet, a wire that is also very short at 80 meters may well be a good vertical antenna at 10 meters!

In addition to being short, an antenna ground wire should be low inductance. Thus, braid or strap should be used. Some people use multiple strands of heavy-gauge wire in order to reduce the inductance. These methods will also reduce the rf resistance of the ground wire. While dc currents flow through the entire diameter of a conductor, rf currents only flow near the surface; this is the so-called *skin effect*. By paralleling conductors or by otherwise increasing the cross-sectional area of the ground conductor, we reduce the conductor resistance.

Conclusion

That a good ground is a worthy goal needs little comment. In order to achieve that goal, we must be cognizant of the nature of the soil around us and of what constitutes a good ground. Obviously, a person operating from a desert community will have to follow a more rigorous path than a person living in a swamp. In either case, it is a matter of achieving a low-impedance path to ground. Some rules of thumb are:

1. Get as much surface of the conductor as possible underground.
2. Use short, low-inductance ground leads.
3. Use a counterpoise ground of quarter-wavelength radials if the two above are difficult to achieve. ■

Build the Dixie Whistler

Adding two-tone SSB analysis to your test repertoire is as easy as one, two, tweet.

Photo A. Two-Tone Plus is an SSB-transceiver and linear-amplifier tuning aid which includes a sync output for stable rf-waveform viewing.

Frank H. Perkins WB5IPM
Box 13642
Arlington TX 76013

Your SSB transceivers and linear amplifiers are going to require periodic testing and adjustment if you intend to maintain clean station modulation. This is a fact of life since amplifier tubes change with time and even solid-state circuit adjustments drift a bit. One of the most helpful accessories for doing your modulation testing is the two-tone audio generator. When a two-tone audio signal is fed through an SSB transmitter, a distinctive rf pattern is formed which can be analyzed on a conventional HF (30-MHz) oscilloscope. The two-tone rf pattern can be used to diagnose most transmitter and linear-amplifier modulation problems. In this article I'll review two-tone test techniques and discuss the operation and construction of a two-tone audio generator which includes a sync output for stable rf-pattern displays.

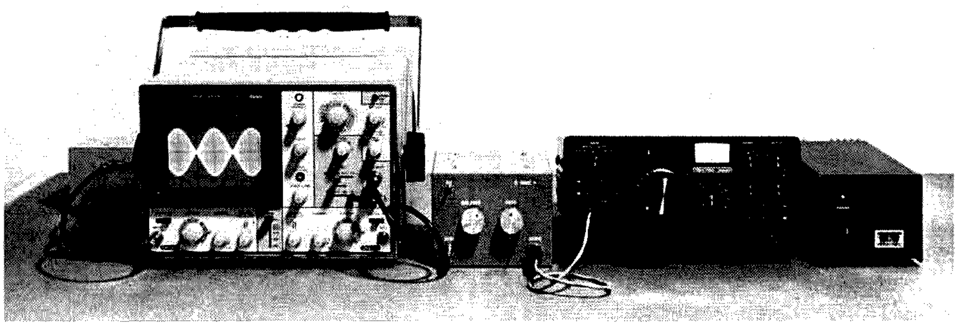


Photo B. Typical two-tone test setup. Refer to the text for high-power testing precautions.

Two-Tone Testing

Fig. 1 shows a typical two-tone test setup. The two-tone audio signal is fed into the microphone jack of the

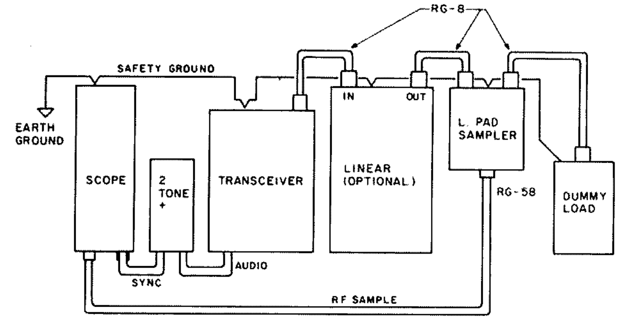


Fig. 1. Two-tone test setup, top view.

SSB transceiver. The rf output of the transceiver is then routed through a linear amplifier (optional) and an L-pad sampler to a dummy load. A low-voltage sample of the two-tone rf signal is taken from the Sample output of the L-Pad to the vertical input of the oscilloscope for display. Take careful note of the safety ground interconnecting each component that operates from ac power and/or interconnects high-power rf. The safety ground should *always* be installed before any equipment is plugged into ac power and turned on.

Photo B shows a typical test setup. The L-pad sampler is on the far left and the two-tone generator is between the oscilloscope and the transceiver. Photo C shows a two-tone pattern indicating clean, linear modulation. Note that the envelope of the two-tone rf pattern appears to be made from two sine waves that are 180 degrees out of phase and connected at their zero-crossing points. Distortions in this classic pattern will indicate various modulation problems.

Fig. 2(a) again shows a normal two-tone rf envelope pattern. Fig. 2(b) shows distortion in the zero-crossing portion of the waveform. This is usually due to the bias current being set too low in the final stage of the transceiver or linear amplifier. (To determine which, test the transceiver by itself.) Fig. 2(c) shows clipping distortion due to overdriving the transceiver or linear. This type of distortion can generate serious "splatter" and should be avoided. The peak-to-peak amplitude where clipping (ALC disconnected) begins should be used as the maximum peak-to-peak amplitude for a voice waveform (to assure clean modulation). Clipping distortion can occur at less than rated power if the load for the transceiver or linear is incorrect, or if the output stage of the transceiver or linear is not properly tuned. Other causes of clipping below rated power include low screen voltage, weak finals, problems in the audio or low-power rf section of the transceiver, and power-supply problems.

Incidentally, certain solid-state transceivers do not work well with some of the older linear amplifiers, especially those linears with untuned inputs. In such instances, clipping distortion or low amplitude will often appear only on one side of the two-tone pattern, as shown in Fig. 2(d). Carrier leakage will cause alternate waveform peaks to be of different heights, as shown in Fig. 2(e), although this is not a sensitive test of carrier suppression. If the unwanted sideband is poorly suppressed, a ripple component will be seen on the two-tone pattern. Fig. 2(f) and Photo D show a two-tone rf pattern due to improper audio tone balance. The balance control on the two-tone audio generator should be carefully adjusted to produce a complete null in the corresponding rf pattern.

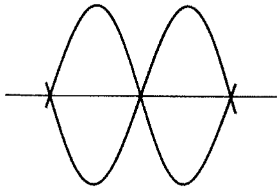


Fig. 2(a). Normal two-tone pattern.

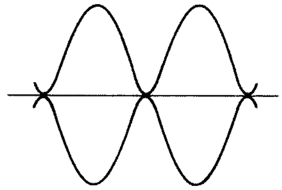


Fig. 2(b). Low amplifier bias pattern.

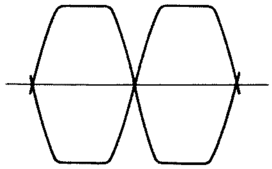


Fig. 2(c). Overdriven amplifier pattern.

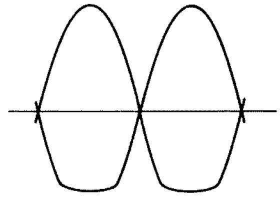


Fig. 2(d). Cycle loading distortion.

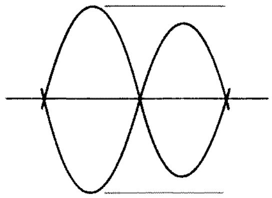


Fig. 2(e). Carrier leakage.

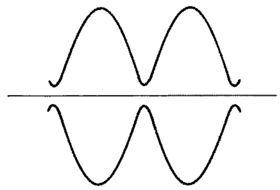


Fig. 2(f). Pattern due to unbalanced tones (not amplifier problem).

Two-Tone Plus

Let's now consider the design requirement of a two-tone audio generator. The generator should provide two low-distortion audio tones in the 300–2100-Hz frequency range, at least 1000 Hz apart. The tones should not be harmonically related, or one of the distortion frequencies (lower 3rd-order distortion product) will wind up on the carrier frequency and create a confusing display. Gain and Balance controls should be provided so the generator can be adjusted quickly for different transceivers.

There is one additional feature that would be

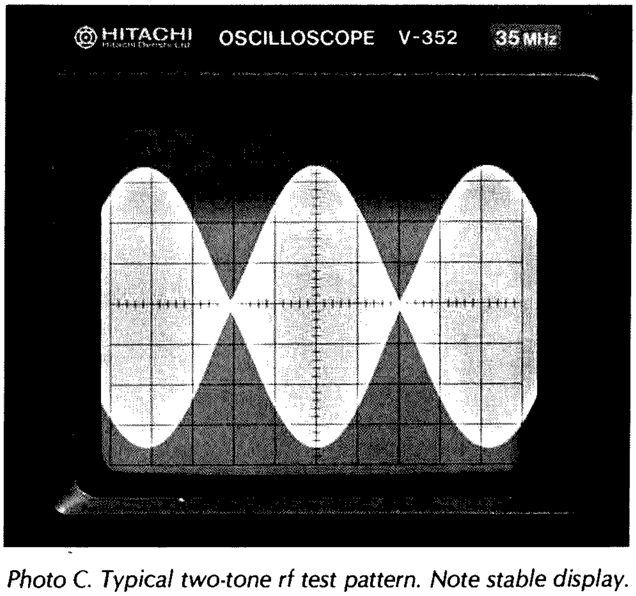


Photo C. Typical two-tone rf test pattern. Note stable display.

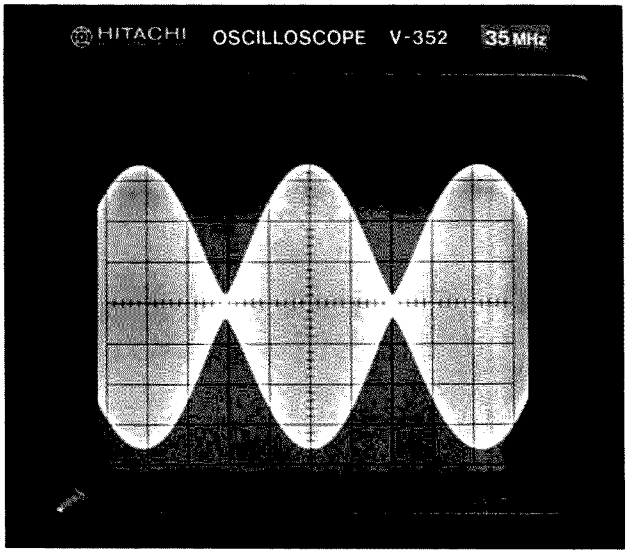


Photo D. Two-tone pattern with audio tones unbalanced. Not an amplifier problem! Always adjust the Balance control for a complete null.

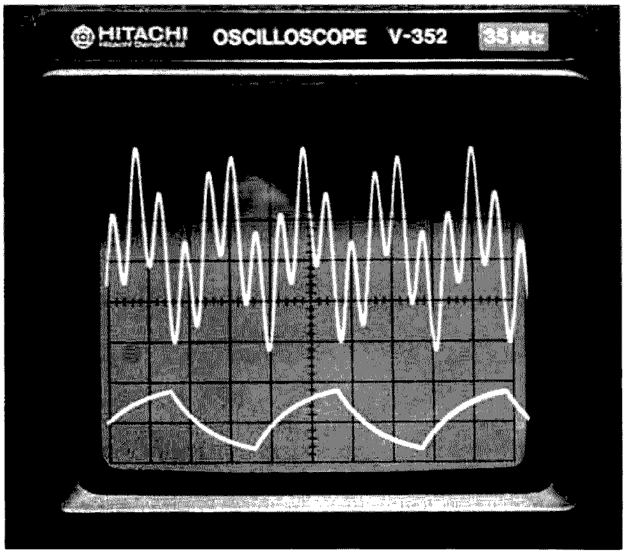


Photo E. Upper trace shows the composite audio output of the Two-Tone Plus generator. Tones are synchronized but are not harmonically related. Lower trace shows sync waveform. Both tones are harmonics of the sync frequency.

nice—a sync output for the oscilloscope. Otherwise, you have to sync on the rf waveform itself, which is quite touchy and tends to be unstable. Trying to sync on one of the audio tones doesn't work (I tried) because the rf-envelope-pattern frequency is equal to the difference between the frequencies of the two audio tones.

Fortunately, a simple PLL (phase-locked-loop) circuit can be devised to provide two tones that are not harmonically related but are both harmonics of the sync output. A few blackboards of higher math will quickly show that the difference in frequency between the tones will also be a harmonic of the sync, which means the scope will sync (?!) to the two-tone rf pattern.

So much for the theory, let's look at the block diagram in Fig. 3. The outputs of two sine-wave audio oscillators are summed in an adder circuit which includes the Balance control. The output of the adder circuit is routed through the Gain control to the audio output jack. The low-frequency oscillator, at about 480 Hz, is also converted to a square wave and divided by two to generate the 240-Hz sync output and reference frequency for the PLL.

Meanwhile, the high-frequency oscillator, at about

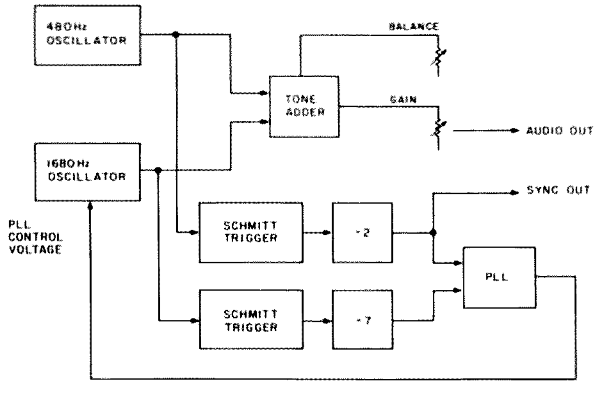


Fig. 3. Block diagram of Two-Tone Plus.

1680 Hz, is divided by seven and compared to the 240-Hz PLL reference frequency. The PLL outputs a control voltage to lock the 1680-Hz oscillator to exactly seven times the sync frequency. Note that the frequencies of the two output tones have a 3.5:1 ratio, so a direct harmonic relationship has been avoided. Also, the difference between the two frequencies is 1200 Hz, the 5th harmonic of the sync output. Photo E shows the two-tone audio output and the sync output of the generator.

On to Fig. 4, the schematic of the generator's analog section. A TL084C quad op amp (IC1) provides all the analog active-device functions. IC1A and IC1B are used as conventional Wein-bridge oscillators with temperature-variable resistor feedback stabilization (R1 and R2). R3 and R7 provide oscillator amplitude adjustments, and R6 provides a fine frequency adjustment for the 480-Hz oscillator. Q1 acts as a voltage-variable resistor and is used to tune the frequency of the 1680-Hz oscillator by the PLL. IC1C adds the two oscillator tones together, with R15 acting as the Balance control. The output of the generator is taken from the Gain control, R25. IC1D is used to provide a ground reference equal to one half of the supply voltage. SW2 allows remote transmitter keying for most transceiver designs.

Fig. 6 is the schematic of the digital section of the generator. IC2 is a quad AND gate which is used for several functions. IC2A and IC2B are used as Schmitt triggers by applying positive feedback from their outputs through resistors R29 and R28, respectively. The 480-Hz signal is converted to a square wave by IC2B, and the 1680-Hz signal is converted to a square wave by IC2A. IC3 is a dual divide-by-sixteen counter. One section is used as a divide-by-two counter by simply taking an output from the first stage of division (pin 3). The second section is forced to divide-by-seven by detecting the count of seven with IC2C and IC2D and immediately resetting to zero. The divide-by-seven output is taken from pin 13. The divide-by-two output is applied to the reference input of the PLL (IC4) and to the network of R30 and C6, which creates the ramp waveform for the

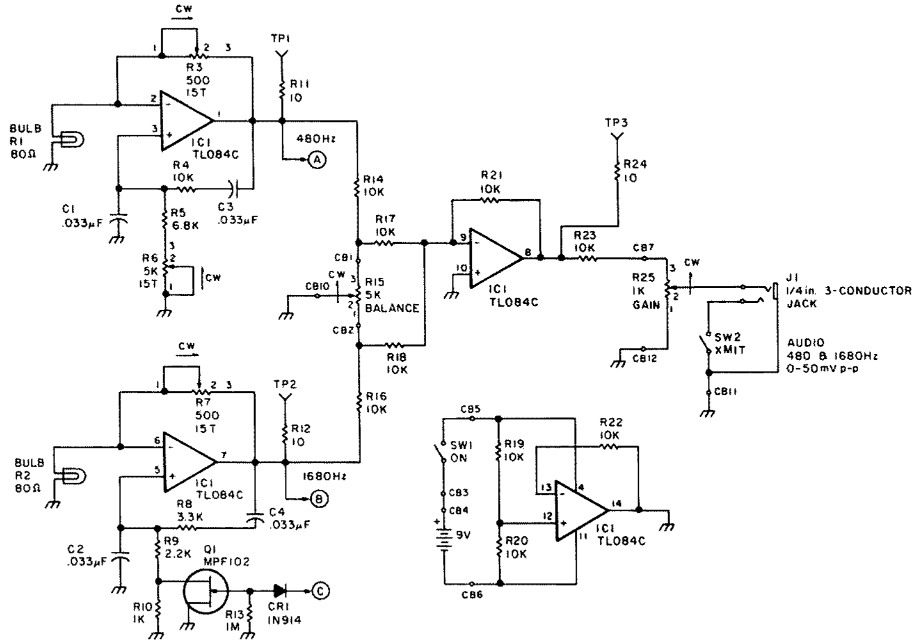


Fig. 4. Analog section.

sync output. The divide-by-seven output from IC3 is applied to the vco input of the PLL, pin 3. The PLL control voltage is output on IC4 pin 13. This voltage drives network R31-R32-C7, which basically sets the dynamics of the loop. R33 and C8 provide ripple filtering for the PLL control voltage, which is routed back to Q1. R34 and R35 provide a test voltage for tune-up purposes.

Construction

Photo A will give you my opinion of a functional front-panel layout and Photo F some ideas on interior arrangement. After receiving many letters asking for circuit-board layouts for my earlier *73* projects (and some coaxing from ye friendly editor), I bit the bullet this time and have done circuit-board artwork. I must admit it speeds up construction. Fig. 6 gives you the circuit-board artwork 1:1. Fig. 7 details parts placement. I used a #70 bit to drill out the IC pads and a #65 bit to drill out the rest. The four mounting holes were drilled out with a 1/8-inch bit.

You should be able to build the project on a perfboard, or wire-wrap (that's a digital term) it if you choose. The circuit board in my two-tone generator is held in place with 4-40 screws, using 5/8-inch-long aluminum tubing as standoff spacers. The tubing has an inside diameter a little larger than 1/8". Notice that I recommend high-quality 2-Watt potentiometers for the Balance and Gain controls. These pots don't creep or get noisy; they are well worth the extra money.

Tune-Up

After construction is complete and you have carefully checked for solder bridges and correct wiring, turn the on/off switch to off and install a *fresh* 9-V battery. Jumper TP4 and TP5 together. Set R3, R6, and R7 midrange (remember these are 15-turn pots). Center the Balance control and crank the Gain control all the way up. Turn the on/off switch to "On" and hook your scope to TP1. Adjust R3 for a 3-V p-p sine wave. At this amplitude there should be no apparent distortion in the sine wave, unless the battery is flat. Adjust R6 for a sine-wave period of just less than 2.1 milliseconds (480 Hz). Amplitude and frequency interact a bit so you may need to adjust R3 and R6 in sequence a couple of times.

Now look at TP2 and adjust R7 for a 3-V p-p output. Using TP1 for sync, again look at TP2. You should see a sine wave "slipping" against sync. Adjust R6 carefully until the 1680-Hz sine wave seen on TP2 nearly stops. Now remove the jumper between TP4 and TP5. The 1680-Hz sine wave should lock in sync within a couple of seconds. Now touch up R3 and R6 slightly, if necessary, for 3-V p-p sine-wave amplitudes at TP1 and TP2, respectively. Both sine waves should be free of distortion. Check the waveform at TP4. It should be between −0.5 and −1.0 V dc, with little apparent ripple. Short TP4 and TP5 together a couple of times while monitoring TP3 to ensure that the PLL readily locks. Check the Audio output jack and the Sync output jack for proper waveforms, as seen in Photo E. Turn the two-tone generator on and off several times to ensure that it stabilizes and locks up reliably. Make any adjustments needed. If you have any problems, review the schematics and the theory of operation for hints.

You will need to make up an audio cable between your two-tone generator and your transceiver. Of course, there is little standardization between microphone connectors. Refer to your transceiver manual for information.

L-Pad Power Sampler

Fig. 8 is the schematic of

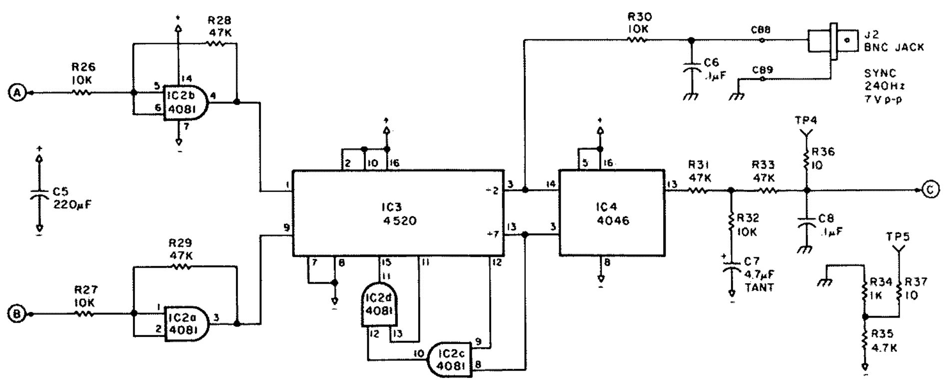


Fig. 5. Digital section.

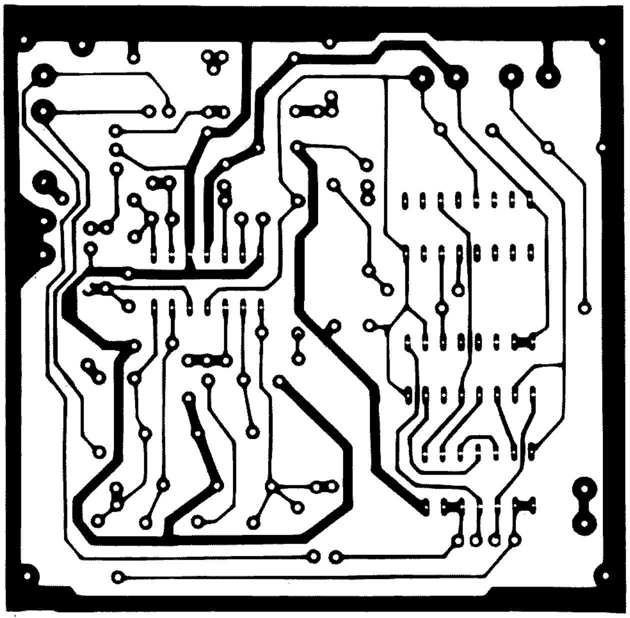


Fig. 6. PCB artwork.

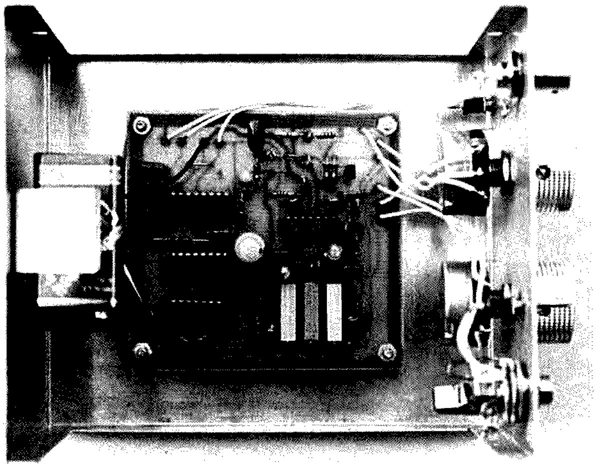


Photo F. Interior layout of the two-tone generator. Construction is quick and simple.

the L-pad sampler and Photo G provides a view of the internal construction. Four pairs of 4.7k, 1-Watt resistors form the series element of the sampler, and a 51-Ohm, 1/2-Watt resistor forms the shunt element. A single hair-thin strand of copper wire from an old "zip cord" provides some fusing protection in the event of a component failure or circuit fault.

Because of the power involved, build the L-pad sampler carefully. The circuit board used to mount the resistors has a very simple pattern (see Photo G) which can be easily etched using masking tape for resist. Note that the resistor sets are spaced 3/8 of an inch apart. Looking at the upper left corner of the circuit board, note that the clearance between the mounting nut and the circuit-board pattern is 1/4" minimum. Note that in the lower right corner of the circuit board, the mounting nut provides a ground point. A ground wire is also taken from this point to the BNC-connector ground lug, which is fashioned from copper shim stock.

The circuit board in the sampler is mounted using 4-40 screws, with 1/2-inch-long pieces of aluminum tubing used as standoffs. The "fuse" wire must be at least 1/2" long. Route it away from the mounting nut in the upper left corner of the circuit board, and from the wall of the minibox. The heavy wire connecting the SO-239 connectors came from the center conductor of a piece of RG-8 coax. The L-pad minibox is a Bud CU-3008-A.

Initial Testing

Prepare to hook up your L-pad to your transmitting equipment. Be sure everything is properly grounded. I suggest mounting the L-pad on an aluminum plate, which is in turn wall-mounted. Ground the plate! Do not connect the L-pad to the scope yet. Connect your transceiver to an swr meter, the swr meter to the L-pad, and the L-pad to a dummy load. Starting with low power (100 Watts or less), key down for 30 seconds. The L-pad should introduce no swr. After key-down, *turn off* all transmitting equipment and quickly inspect the interior of your L-pad. The fuse should be OK and nothing should be hot. Continue testing to full station power. If everything has gone well, *power down* all transmitting equipment and connect in the oscilloscope and two-tone audio generator. Be sure all safety ground wiring is hooked up (refer to Fig. 1). Set your scope to one volt/

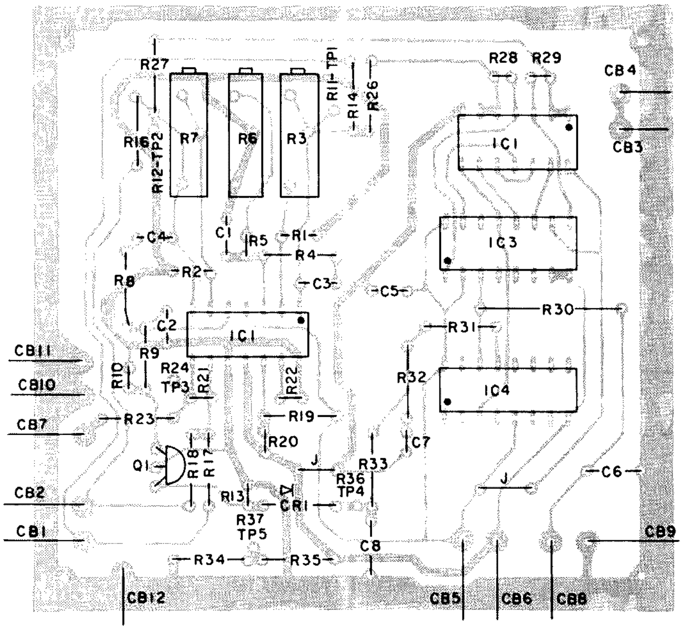


Fig. 7. PCB parts placement.

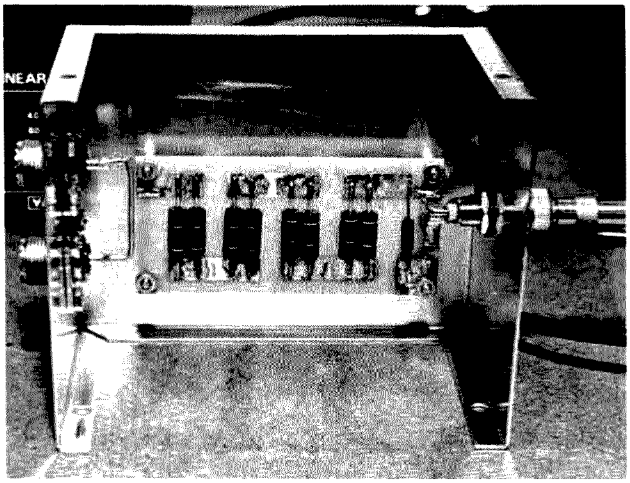


Photo C. Construction detail of the L-pad sampler. Although simple, build the L-pad carefully since it handles high power.

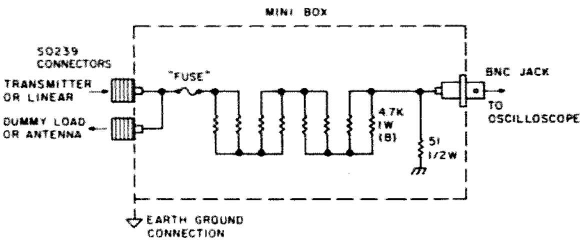


Fig. 8. L-pad power sampler. All resistors comp. or film (non-inductive). Fuse is thin copper strand from zip cord, 1/2" to 3/4" long. Connect SO-239 connectors with RG-8 center conductor wire. Keep BNC connector 3" away from SO-239s; space resistor sets 3/8" apart. Test run sampler at full power before connecting to scope. Maximum power 2 kW PEP; 1 kW CW. Maximum vswr 2:1.

division. Turn the two-tone generator on and allow it to stabilize. Be sure the Balance control is centered and the Gain control is turned down. Key the transmitter from the Xmit switch on the two-tone generator and adjust the Gain control and scope settings for a display similar to Photo C. How does the modulation look? Continue testing to full station power. Remember, don't go over 2 kW PEP. When using the L-pad sampler, don't exceed an swr of 2:1.

Parts List

Circuit Board

TL084C	Quad op-amp IC	IC1	1,2
4081BE	Quad AND gate CMOS IC	IC2	1,2
4520BE	Dual ÷ 16 CMOS IC	IC3	2
4046BE	PLL CMOS IC	IC4	2
MPF102	JFET	Q1	2
1N914	Diode	CR1	1,2
RS 272-1141	12-V-dc, 25-mA lamp	R1-R2	1
43P500	15-turn, 500-Ohm pot, ¾ W	R3, R7	2
43P5000	15-turn, 5000-Ohm pot, ¾ W	R6	2
MY .033/100	.033-uF mylar™ cap, 100 V dc	C1-C4	2
MY .1/100	.1-uF mylar cap, 100 V dc	C6, C8	2
R 220/16	220-uF, 16-V-dc radial elect.	C5	2
TM 4.7/35	4.7-uF tantalum cap, 35 V dc	C7	2

Other resistors are ± 5%, ¼-W, metal film.

Chassis

CU3007A	Bud 6" × 5" × 4" minibox		local
CMU5021	5k-Ohm, 2-W pot	R15	2
CMU1021	1k-Ohm, 2-W pot	R25	2
RS 274-323	¼", 3-conductor jack and plug	J1	1
RS 278-105	BNC connector	J2	1,2
RS 275-324	SPST miniature toggle switch	SW1-2	1,2

Plus hardware, 22 AWG wire, battery, clip, etc.

Suppliers

1. Radio Shack
2. Jameco Electronics, 1355 Shoreway Road, Belmont CA 94002, (415)-592-8097.

Note: Equivalent components are available from many other suppliers.

Closing Thoughts

Some of the newer transceivers feature tuning controls on the microphone and are probably going to be difficult to interface directly through the microphone connector. For these rigs, try running the two-tone audio signal through an amplifier and low-distortion speaker. Just hold the mike in front of the speaker and key up. Not ideal, but better than nothing. Many transceivers and linears heat up quickly when running two-tone tests. Don't test too long each time, and allow generous cool-down periods. Be careful. You can be very seriously burned on high-voltage rf, and high-voltage dc shocks can be lethal. Use the utmost care when testing and maintaining your station equipment.

If you would like to ask me a question about this article, please send an SASE. 73!■

Dallas Williams WA0MRG
PO Box 1
Sedgwick CO 80749

In Search Of: RTTY

Experience the mysterious world of RTTY beyond the band edge, but beware! Its allure's too great for all but the stoutest of heart.

One of the most fascinating aspects of radioteletype is monitoring the thousands of commercial, military, and governmental broadcasts which go on daily outside the ham bands.

Not only can anyone copy such services as AP (Associated Press) and UPI (United Press International), which are the two we are most familiar with in this country, but also TASS (Telegrafnoye Agentstvo Sovetskogo Soyuza) from the Soviet Union, AFP (Agence France Presse) from France, Reuters from England, and dozens of others.

Since this was written, the TASS and Prensa Latina services from CLN-451 on 14,901 kHz have been transferred to CLN-452 on 14,928. Also, the American Republics Wireless File afternoon transmissions have been discontinued, and that material has been added to the morning schedule. This was done to counter poor propagation to those posts not linked by computer net.

Maybe you would like 24-hour weather from just about anywhere in the world, or to feel like a spy and print out embassy communications. (The stuff is in code and impossible to read but it still gives a feeling of excitement.) Maybe you would like to practice reading Spanish, French, or some other language. It is all there between the ham bands and easy to copy—if you know how and where.

Equipment

To receive commercial RTTY such as this requires the usual amateur RTTY equipment and maybe a few additions. First, of course, you need a good general-coverage receiver. Those who have one of the new transceivers with built-in general coverage are all set. The rest of us will have to make do with something else. In general, if the receiver is stable and selective enough to do a good job on SSB signals, it will perform nicely for commercial RTTY.

I use an old Collins R388 (with added mechanical filters) or a pair of Hammarlund SP600/JX17 war-horses, and they do nicely. The Collins is the better due to the much more accurate frequency readout, something that is important when trying to locate or identify particular stations. For a long time I used a BC348 military receiver. Using a big expensive receiver is not really required for starting out.

While it would be nice to use special antennas, they are not necessary. The regular ham antennas will do very well.

For the terminal unit, the regular amateur type will work very satisfactorily provided it can handle shifts greater than 170 Hz. Many amateur TUs are built only for 170 Hz and will be of little use. Most commercial RTTY transmissions are 425- or 850-Hz shift, although a small number can be found ranging from about 50 to over 1000 Hz.

Selectable sense is a must. For the most part, the commercial stations are not plagued with the interference found in the amateur bands. For this reason, even a simple phase-locked-loop demodulator without filters will do a surprising job.

If you use a computer to decode the signals, several things should be kept in mind. First, the software should be able to handle all speeds from 45 to 74.2 baud Murray. (While Murray and Baudot are not the same, nearly everyone treats them the same.) While some ASCII, SITOR, and other modes are in use, most of the action is still with the 5-level Murray code at speeds of either 50 or 74.2 baud. It seems amateurs are about the only ones using 45 baud. In three years of daily monitoring, I have never copied a transmission using 56.9 baud (75 wpm). That does not mean 75 wpm is unused, but that would appear to be the case.

Second, with some sys-

tems the length of the stop bit can cause problems. This is particularly true in computer systems that use the cassette port as a TU and where the stop-bit length is determined by a machine-language timing loop. In these systems, serial-to-parallel conversion is done by machine language rather than UART. I faced this problem with software I had written for the Timex/Sinclair TS1000. The stop-bit timing loop would still be running while the next character was being transmitted. The result was garbage. Dedicated systems do not have this problem. Also, if the software is written for a stop-bit length of 1 or 1.5 data bits, there should be no problems.

Those who use UART serial-to-parallel-to-serial upspeed converters to drive a standard teleprinter should also be aware of the stop-bit-length problem. The UART should be set for the shortest stop bit possible, usually 1.5. The speed converter will be compatible with any signal using a longer stop bit. The reverse, however, is not true. Normal 5-level code calls for a stop-bit length of 1.5, but many military and weather transmissions use a stop bit equal to 2 data bits. Obviously, timing errors will occur on full-speed transmissions using a stop bit shorter than that of your speed converter.

Actually, there are a number of "standard" stop-bit lengths. The 60-wpm system used by amateurs is actually 61.3 wpm with a stop-bit length of 1.42. Other stop-bit lengths include 1, 1.27, 1.5, 1.97, and 2. The standard international system of 50 baud (66.6 wpm—usually called 66 or 67 wpm) uses a stop bit of 1.5. However, many of the 50-baud transmissions encountered on the air use a stop bit of 2, which is 62.5 wpm.

In truth, the wpm figure is somewhat meaningless. The longer stop bit allows the receiving equipment to maintain synchronization better if the start pulse is clobbered by interference. This is why most cryptographic transmissions use the longer stop bit. One missed character could require the entire transmission to be repeated.

If all this sounds confusing, do not worry too much about it. But if you have errors in your copy that you cannot explain, then you might take a closer look at the stop-bit lengths involved.

Another thing to consider is the various keyboard layouts in use by the different services. Weather services have, in the past, had their own special keyboard with symbols to represent different weather conditions. This system may still be in use, although I have found no indication of it. Most foreign press services use the CITT No. 2 system. If received on an American Communications system (the kind in use by most amateurs), problems can occur. For instance, with the CITT system, a shifted S is the apostrophe rather than the bell, as on the American Communications system. This means that every time they send an apostrophe your bell will ring; do not assume something is wrong with your receiving equipment.

Those with a standard American Communications keyboard (or software) and an active bell in their system will soon find it desirable to disconnect it, especially when receiving some French transmissions. French transmissions are not the only problem, however, as many press services use a double apostrophe in place of quotes. This is because the CITT system has no quote key; it has a plus sign in its place.

While I am set up to use the computer as a RTTY monitor, in practice I prefer the old teleprinter machine to do most of the work. While it is noisy, I am not locked into a given amount of memory. Thus, I can set up on a service, print eight hours worth, and read it at my leisure. TTY paper is far cheaper than paper for the line printer. Also, it does not tie up the computer for long periods of time when I could be using it for something else. It is the best of both the old and the new.

ADN—Allgemeiner Deutscher Nachrichtendienst (East Germany)
ANA—Aden News Agency (Yemen)
ANGOP—Agencia Angola Press
ANSA—Agenzia Nazionale Stampa Assoc. (Italy)
APN—Agentstwo Petschato Novosti (USSR)
CNA—Central News Agency (Republic of China)
DIPLO PARIS—French Ministry of Foreign Affairs
DPA—Deutsche Press Agentur (West Germany)
DYN—Diarios y Noticias (Argentina)
KCNA—Korean Central News Agency (North Korea)
KUNA—Kuwait News Agency
MAP—Mutual Arab Prass (Morocco)
NA—Noticias Argentinas
PAP—Polska Agencja Prasowa (Poland)
SAPORITI—Agencia Noticiosa Saporiti (Argentina)
SUNA—Sudan National News Agency
TANJUG—Telegrafska Agencija Nova Jugoslavija (Yugoslavia)
TELAM—Agencia de Noticias Telam (Argentina)
VNA—Vietnam News Agency
XINHUA—New China News Agency (People's Republic of China)
YONHAP—Yonhap News Agency (South Korea)

Fig. 1. Foreign press services.

Tuning

Tuning commercial RTTY transmissions is much the same as tuning amateur signals, with one possible exception. If you have depended on your ears as a tuning guide for amateur signals, you will find that things sound different. This is because the commercials use a wider shift. It should not take long to get to the point where you will be able to recognize the shift just by hearing the signal. An oscilloscope is still the best tuning aid.

If after tuning in the signal properly and identifying the shift being used the resulting readout is garbage, then several things could be wrong. The first is that your equipment may be set for the wrong speed. Change speeds and try again. (After some practice you should be able to identify the speed just by ear.) If changing speeds does not clear up the copy, try changing the sense. Some combination of speed and sense will usually yield good copy—if the transmission is printable.

Finding a Signal

Now that everything is ready to go, where do you look for a signal? Probably the easiest to receive are the WBC weather transmissions from Miami, Florida. These are on 24 hours a day on over a dozen frequencies. Try 8105, 8130, and 8140 kHz. These are usually best in the evening and at night. The 8140-kHz frequency is taken over around 0700 UTC by Castro's propaganda arm, Prensa Latina (PL), so be forewarned.

The weather reports are sent at 74.2 baud (100 wpm) with a shift of 850 Hz. Most are in weather code, which is not readable without a key (available at most large libraries), but you will be able to tell how well your system is working by using these stations. Like most

commercial and press stations, they do not transmit data continuously, so for 10 or 15 minutes at a time you may hear only a mark carrier. Since these three stations do not transmit the same data at the same time, if one is idle, try another.

For news with a different slant, try the PL transmission at 0700 UTC on 8140 kHz. It is in English with a speed of 50 baud and 425-Hz shift. Other active PL frequencies are 14,901 and 16,348 kHz. Daily sign-on for these latter frequencies is around 1730 UTC (it changes from day to day) with "news" in English for Central America. Cuban transmissions are not known for their stability and may disappear in mid-sentence. The English is rotten and misspelled words abound—don't blame your equipment.

The Cubans also relay a TASS English transmission on 14,901 kHz. This starts around 1200 UTC and continues until the sign-off—usually between 1600 and 1700 UTC. TASS has far more polish than PL and the English is much better. While all of these transmissions are normally 50 baud with 425-Hz shift, don't be surprised if one shows up at 170-Hz shift or if the sense changes from day to day. Even the speed has been known to change. (As I write this they are using 45 baud!) The signal also may drift or even suddenly shift frequency by several hundred Hertz and just as suddenly shift back minutes later.

The Cubans (or at least my limited Spanish leads me to that conclusion) also operate several other services, Prensa Minrex and what is labeled Embacuba. These seem to have no set schedule or frequency. Sometimes they appear to be the same. Usually the transmissions contain Spanish text and/or messages made up of 5-number code

WBC—National Weather Service (USA)
JMI—Japan
333—USSR (from RVW 53)
AMMC—Australia

Fig. 2. Examples of weather service identifier codes.

groups. Another that seems to be Cuban uses the military-type callsign DIME. Transmissions are in Spanish and have been copied changing speed in mid-sentence.

For serious copying of weather transmissions, the unshift on space (USOS) function should be turned off. Since both weather and the coded traffic of embassies (and the like) are nearly all in number groups, it is far easier to read if it is printed properly. Most of the transmissions appear to be sent with the assumption that the receiver does not have USOS. For the press services, however, using the USOS corrects more errors than it causes.

The USOS should also be used when copying traffic transmitted in the Cyrillic alphabet used by the USSR and other countries. Without USOS, most Cyrillic transmissions look like so much garbage. With USOS, however, it is possible to read a word now and then and maybe even get an idea of what the traffic is about. Cyrillic transmissions come in two types: 2 level and 3 level. The 2 level is just like the regular keyboard with upper and lower case, although the characters are much different. The 3 level, which appears to be the most common, has a second additional shift allowing access to another group of characters. The regular Murray machine prints these extra characters as numbers or punctuation.

To receive some of these Russian stations, try 16,700 kHz plus or minus 10. If propagation is good, several can usually be heard. Nearly all use 170-Hz shift. I have noticed several strong Russian stations around 12,500 kHz, also. Recently copied callsigns include UWFW and UEFZ. Much of the traffic will have easily-readable tags such as Radio Murmansk and Odessa Radio.

If you would like to practice your Spanish, there are a number of easily-copyable signals available. The easiest to receive (at least at this location) are the AFP Paris transmissions relayed via New York or, depending on the frequency, Martinique. These run sporadically throughout the day. Try 15,908 kHz for the New York relay (via WEY 35) and 16,183 kHz for the Martinique relay (via FZF 62). The Martinique transmission is supposed to be in Portuguese for Brazil, but it looks like Spanish to me. Also, the Martinique signal may be difficult to tune, as a direct Spanish transmission from Paris can be heard on 16,184 kHz. All of these use 50 baud with 425-Hz shift. AFP has also been copied in French on 18,669 and 15,978 kHz, and in English on 15,977 kHz, among others.

Reuters, the British news service, can often be copied on both 18,334 and 18,336 kHz, although the conditions are not very good at this location. Those on the east coast can probably receive them better. I have received them as early as 1500 UTC. They use 325-Hz shift. Another frequency to try is 10,959 kHz around 0400 UTC.

UPI in English from Hong Kong can be copied on 19,520 kHz when propagation is favorable. I have had the best luck during the late evening and early morning hours. AP and UPI transmissions are hard to find, as most have been shifted to satellites.

The United States Government also has a RTTY press service. Depending upon which one you receive, it can be called the VOA (Voice of America), USIS (United States Information Service, aka United States Information Agency), the African File, the Asian File, and for South America, ARF (American Republics Wireless File. In any case, all come from the USIA in Washington.

These transmissions, unlike most foreign government press services, do not seem to be aimed toward the general public but to USIA posts in the target area. Much of the material is "for mission staff only and not for publication." The rest of the material is in English and is then repeated in the languages of the target area. Several times a month they list job openings within the agency along with media reports and other "inside" information. Also, unlike most press services, these use 74.2 baud. Because of this speed, you can expect a higher error rate in your copy. The shift is usually 425 Hz, but this seems to be slightly variable. Some of the transmissions appear to be about 80-Hz shift and multiplexed and transmitted on independent sideband with VOA SSB feeder transmissions.

ARF begins "sked 2" at about 1715 UTC on 14,638 and 18,542 kHz, among others. (I have never found "sked 1"—if there is one—and recently I noticed they dropped the "sked 2" introduction label.) These are 74.2 baud at 425-Hz shift. The transmissions open with about 15 minutes of RY tester and callsigns. "Sked 3" begins at 2015 UTC using the same format and frequencies.

Overseas VOA transmissions can be copied on a number of frequencies,

among them: 5460, 7442, 10,972, and 13,995 kHz.

Identifying the Service

Sometimes, identifying which news service you are copying can be difficult. Most, however, will begin a news item something like this:

NEW YORK JULY 17 (TASS)—THE UNITED NATIONS. . .

This makes the news service easy to identify—if you know that TASS is one of the Russian agencies. Some are not that easy. A list of agencies and the countries involved is given in Fig. 1. It is by no means complete but should give the first-time monitor a good start at identifying a news service.

I have been able to copy, during the past year, all of the agencies in Fig. 1. With favorable propagation, they should be easily copied.

Identifying weather transmissions is not as easy as press services. Some, when not sending weather data, will slip in a few RYRYs and an ID. Most do not. Some do use a special code at the beginning of each message. If this code is known, then the station can easily be identified. Fig. 2 gives a few examples of these codes.

Some stations alternate RTTY data with FAX and some carry other traffic besides weather. If you know how to read the reporting codes used to identify the weather station that is reporting the data, then you can get a pretty good idea where a transmission is coming from. The book needed to do this is called *National Weather Service Communications Handbook Number 4: Index Numbers for North and Central America, the Caribbean, and U.S. Stations in the Pacific*. The book also contains a condensed listing of worldwide index numbers.

A second book, *Federal Meteorological Handbook Number 2: Surface Synoptic Codes*, will help to decode the weather data. Both books should be available at larger libraries. The weather code, by treaty, is used worldwide. At this writing, some changes are being made in the format of the reports, but the codes should remain unchanged.

It should be noted that while the US and Canada use 74.2 baud for weather transmissions, most of the rest of the world uses 50 baud, with 850-Hz shift being the most common.

As a rule, military transmissions are not printable, but many stations can be identified when they run tests in the clear. Also, a goodly amount of unclassified traffic is transmitted in the clear and is copyable. This seems to be especially true during exercises that "they" want "someone else" to monitor. The best time to catch military stations seems to be the weekends. Then they usually have no traffic and occupy the frequency with an ID and RY or SG tester.

Testers and Callsigns

There are a number of variations in testers used by the commercial stations. The standard QUICK BROWN FOX is used frequently but may have a word or two changed or added. Diplo Paris uses a French tester: VOYEZ LE BRICK GEANT QUE J'EXAMINE PRES DU WHARF, which loosely translates to "see the big ship I am inspecting at the wharf." Probably the most interesting tester is OF ALL THE FISHES IN THE SEA, THE MERMAID IS THE ONE FOR ME. Not all stations use RY testers, either. Some, especially South American, use SG. Many US military stations use a combination of both. At least one station (YBU) uses the shifted RY tester, 46.

Callsigns can look a little strange if you are not used to them. Some examples: Y7A63 (East Germany), ZVK (Brazil), JAN24 (Japan), MSS (Belize), C8J (unknown), IT (unknown), RETJXX (Spain?), FTU8B (France), and the like. "RCC Habana" is not a Russian in Cuba. RCC stands for Radio Corporation of Cuba.

Fig. 3 is a list of some frequencies that have been active at this writing. Frequencies given are close but may vary one or two kilohertz due to the offset of the receiver used. Also, some services seem to shift frequency slightly on an irregular basis. I tried to use the mark frequency, but that did not always work out.

Most of the stations in Fig. 3 should be easy to receive. It is only a small sample of what can be copied. If no baud rate and shift are given, then assume 50/425. The times given are approximate and are not necessarily times when the station may appear. They are, however, times that my log shows they were there.

There are a number of good RTTY frequency-listing books available and the serious monitor should have at least one or two. Since frequencies, times, sense, and speed may change from day to day, no book or listing can be completely accurate. But they still can be of enormous help.

Conclusion

Do not expect every RTTY signal heard to yield something printable. At least half of the transmissions found on the air will not print at any combination of speed, sense, or shift. Many are not 5-level codes, some use bit inversion and/or bit shifting (a nice challenge for those who want to change their software), some use SITOR, some use various forms of multiplexing, and some appear to be downright scrambled.

Sometimes it is hard to tell just what is what. Some languages are hard to identify. I have some stuff I have copied that no one yet has been able to identify, after six months of asking!

That is all part of the fun of monitoring RTTY transmissions outside the amateur bands.

Good Luck! And good hunting! ■

10,408—6VU (Dakar, Senegal) 50 baud/425, nightly
13,487—ANSA (in French and English) 50 baud/425, 1800 UTC
14,508—D4B (Cape Verde) 50 baud/850, 0000 UTC
14,630—ANSA (in French) 2000 UTC
14,640—ZAMINI PRAHA (Czech embassy traffic) code groups, 74.2 baud/425, 1900 UTC and others
14,700—TASS (in English) 1800 UTC
14,880—JMG weather (Japan) 50 baud/850
15,693—ANSA sign on at 1500 UTC
15,724—ANSA sign on at 1500 UTC
15,962—LOL (Argentine Navy) 50 baud/425, sporadic
15,996—DPA (in English) 1630 UTC
16,106—DIPLO PARIS (FZF61) daily during week
16,137—RCC Havana, daily, sometimes with cable traffic
16,187—4UZ (United Nations) 74.2 baud/425, sporadic
16,417—ADN (in Spanish) 2000 UTC
16,440—WBC weather
16,932—CCS (Chilean Navy) 50 baud/850, sporadic
17,610—YBU (unknown) appears weekdays at 2200 UTC. Sign on with ID and QTC number sent via FSK CW followed by coded RTTY.
18,550—NBA (US Navy, Panama) 74.2 baud/850, sporadic
18,650—PAP (Poland) 1700 UTC
18,765—WBC weather

Fig. 3. Some active frequencies. All frequencies are in kilohertz.

Take a Hike

Combine a regulated power supply with a lightweight rechargeable battery. Add a smart control system. The result? Incredible versatility!

Jack Geist N3BEK
2205 Henderson Avenue
Silver Spring MD 20902

The general availability of small, lightweight, solid-state transceivers has made *truly* portable ham-radio operation possible. What is needed to complete the picture is a lightweight, compact, easy-to-handle twelve-volt power source that can be plugged into 60-Hz power where available or will supply power from a storage battery when commercial power is not available.

Any voltage-regulated power supply in the three- to five-Ampere range that can be adjusted to near 15.5-volt output and a fourteen-Ampere-hour motorcycle battery integrated with battery-charging and switching circuits will meet this need. A power supply and battery of these ratings can be easily lifted and carried. The power supply will charge a fully-discharged fourteen-Ampere-hour battery in a reasonable time, and either the battery or power supply will carry the load of a portable rig (such as a hand-held transceiver and rf power amplifier). Appropriate integrating circuitry and a packaging design concept unique to this application will be described.

The Lead-Acid Battery

Hams have become well acquainted with small completely sealed nicad batteries. The lead-acid battery is a different animal. Although there is one in every automobile, they are not exactly common household (or ham-shack) items. A few words of advice and considerable caution are in order:

- Use *extreme care* in handling batteries. Electrolyte is highly corrosive and will cause serious burns to the skin. Wear safety goggles when handling electrolyte. When diluting sulphuric acid, *always add acid to the water*—and do it *slowly*. If water is added to acid, heat generated in the mixing will cause boiling and splattering.
- Fully charging a lead-acid battery causes some hydrogen and oxygen to be vented as a result of electrolysis. Charge batteries in open, well-ventilated space. Do not smoke or expose a flame or electric spark near a battery being charged.

It is safe to charge an automobile or smaller battery in an open, well-ventilated

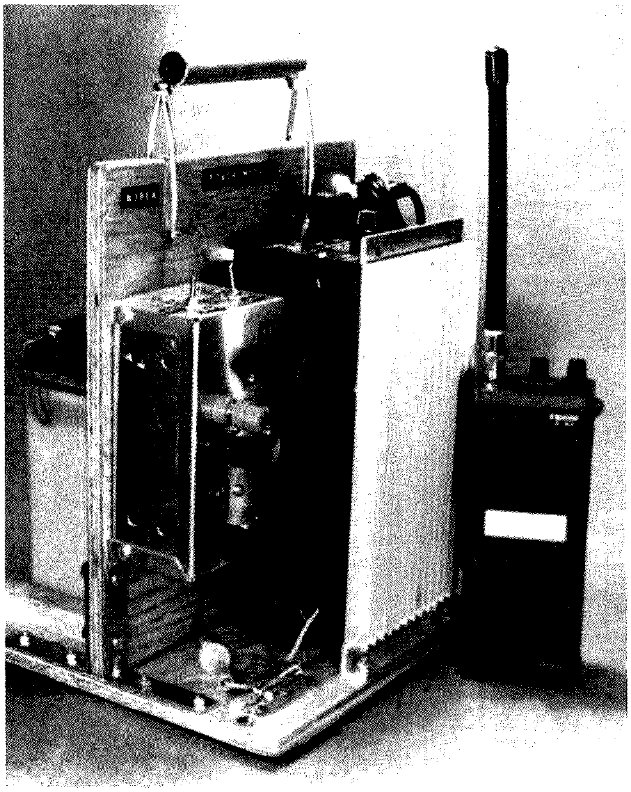


Photo A. Power supply and control box mounted on one side of plywood frame.

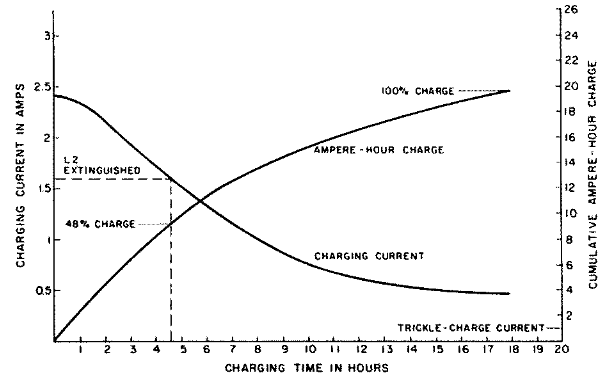


Fig. 1. 14-Ah motorcycle battery charging characteristics.

room, particularly with the constant-voltage method, since the decreasing current as full charge is approached results in only modest gassing. Even so, smoking in the vicinity of a battery being charged *is not advisable.*

It is desirable to have a hydrometer available for checking the specific gravity of the battery electrolyte and to use for replacing water lost by electrolysis. *Use only distilled water* to bring electrolyte up to the proper level. Small hydrometers suitable for the small filler holes in motorcycle batteries are available from auto-parts stores and cycle shops. *Take deliberate care when using the hydrometer*—tiny splattered drops of electrolyte cause nasty corrosion spots on instruments and equipment and surprising "moth holes" in clothing.

Motorcycle batteries are well suited to the power-module application. Their filler holes are sealed, and all cells are vented through one opening and a piece of flexible plastic hose. Although not intended for deep discharge applications, they will, if properly maintained, give good performance and long life in amateur-radio service. Unlike nicads, lead-acid batteries do not have a memory; they can be discharged to any level and recharged from that level. Low-current overcharging is not harmful and is used normally to ensure maintaining 100% charge. Hence the charge cycle does not have to be carefully timed. Except for the acid electrolyte, lead-acid batteries are quite friendly.

Control and Switching Circuits

Control and switching circuits for the power module must perform the following functions:

- Charge a completely discharged battery in a reasonable time
- After charge, supply a low-current trickle-charge whenever the power supply is energized
- Supply equipment power at a voltage of 13 to 14
- Select either power supply or battery power
- Disconnect the power module from the load

Consider first the battery-charging function. The instructions supplied with motorcycle batteries specify constant-current charging with current values of approximately one-tenth the Ampere-hour rating for periods of from 10 to 16 hours. With the power supply as a charger, constant-voltage charging must be used (as is standard for vehicular charging equipment). In constant-voltage charging, the charging current is several times the constant-current value at the beginning of charge and tapers to a fraction of the constant-current value for the last 35% of the total charging time (while the battery is receiving the last 10% to 15% of charge). A charging voltage of 15.5 will fully charge the battery in nearly the same time specified for constant-current charging.

With a charging voltage this high, the initial current must be limited to prevent damage to the power supply and to prevent shortening the life of the battery. Current limiting can be provided with a low-value series resistor.

Total charging time can be considerably reduced if the resistor is nonlinear so as to provide a high resistance when passing high values of current and practically no resistance at low current. By a happy coincidence, a standard 6-volt, 24-Watt, high-intensity incandescent lamp (no. 1133) has a resistance characteristic exactly suited to a 14-Ah battery being charged at 15.5 volts. With the lamp as a series resistor, charging is accomplished with the "constant-voltage, current-limited" method.

A graph of the charging characteristics of a completely discharged 14-Ah battery is shown in Fig. 1. Charging current limited to 2.4 Amps approaches a constant 0.4 Amps in 15 hours. Complete charging requires about 18 hours. The 0.4-Amp final current is too high for a trickle charge, but a lower charging voltage would prolong charging time. Therefore, a means of reducing to trickle-charge current must be provided. (Will anyone

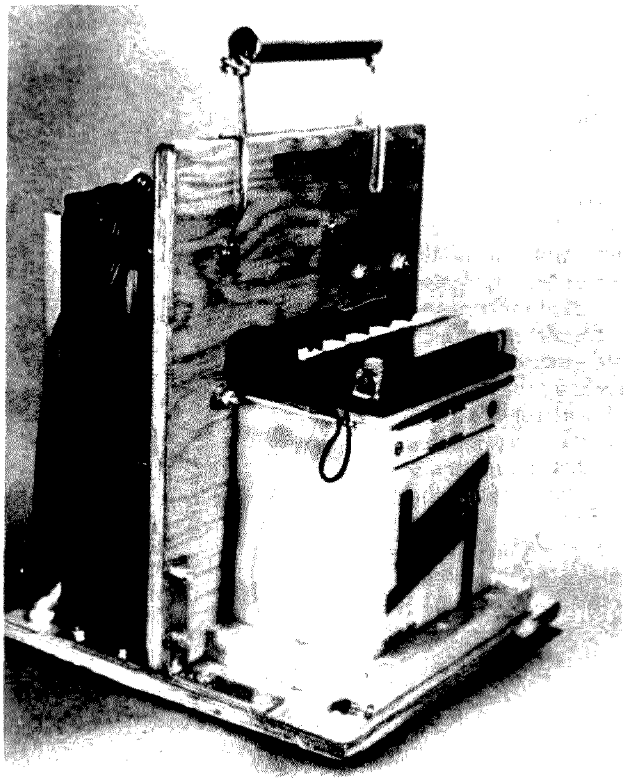


Photo B. Motorcycle battery isolated from electronic equipment by vertical member of frame. Battery is mounted in shallow well and secured at the top with an aluminum-wire bracket. All cells are vented through the plastic tube on the side of the battery and directed away from the frame.

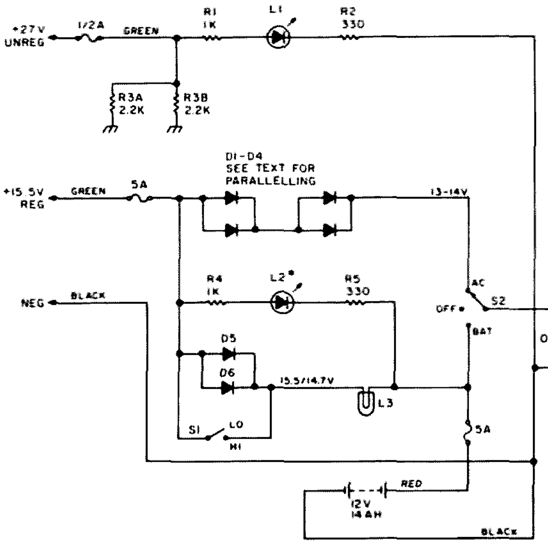


Fig. 2. Power-module control circuits.

The number of Ampere-hours delivered by a fully-charged battery depends on the value of the load current. A 14-Ah motorcycle battery under a continuous average load of one Amp delivered approximately 14 Ampere-hours when discharged to ten volts. With an average load of two Amps, the output dropped to 13 Ampere-hours. A continuous load to full discharge is not representative of battery operation in amateur-radio service. A more typical test was run with a repetitively-cycled load of 3.2 Amps (transmit) for 3 minutes followed by 125 mA (receive) for 9 minutes. The reults of this test are plotted in Fig. 4, showing the battery voltage at the end of each light- and heavy-load cycle.

The heavy-load curve shows the precipitous drop in voltage characteristic of the lead-acid battery after it reaches about eleven volts. When the battery was fully discharged by the 3.2-Amp load, the heavy-load cycle was reduced to 1 Amp, after which a useful value of voltage was delivered for an additional half hour. At the end of the fourteenth hour, the load was reduced to 125 mA continuous, the load of a hand-held transceiver operating on a "mobile stand." After a half hour on this load, the transceiver delivered rated two-Watt output with the battery voltage at 10.5—there was still some usable charge available. This discharge performance represents a lot of HF, QRP, or VHF operation.

The contribution to this project made by Jim King WB3JZI is gratefully acknowledged. The original idea for the portable power module was his. He suggested the battery-charging circuit, supplied some parts, and helped with testing along the way to the final design. Also, photography is by Jim King. ■

BARTER 'N' BUY

Individual (noncommercial) .... 25¢ per word
Commercial .... 60¢ per word

Prepayment by check or money order is required with your ad. No discounts or commissions are available. Please make your payment to *73*. Rates for multiple insertions are available on request.

Advertising must pertain to amateur radio products or services. No special layouts or positions are possible. All advertising copy must be submitted typewritten (double-spaced) and must include full name and address. Copy limited to 100 words, maximum. Count only words in text. Address, free.

73 cannot verify advertising claims and cannot be held responsible for claims made by the advertiser. Liability will be limited to making any necessary corrections in the next available issue.

Copy must be received in Peterborough by the 5th of the second month preceding the cover date.

Send to Barter 'N' Buy, c/o Nancy Ciampa, Advertising Department, *73*, Elm Street, Peterborough NH 03458.

MOBILE IGNITION SHIELDING. Free literature. Estes Engineering, 930 Marine Drive, Port Angeles WA 98362. BNB006

MILITARY TECHNICAL MANUALS for old and obsolete equipment. 60-page catalog, $3.00. Military Technical Manual Service, 2266 Senasac Ave., Long Beach CA 90815. BNB045

REPAIR, alignment, calibration. Collins written estimates, $25; non-Collins, $50. K1MAN, (207)-495-2215. BNB117

IMRA—International Mission Radio Association helps missionaries by supplying equipment and running a net for them daily except Sunday, 14.280 MHz, 1900–2000 GMT. Br. Bernard Frey, 1 Pryer Manor Rd., Larchmont NY 10538. BNB123

NEW HAM-SWL SOCIETY for unity of thought & learning. Open to all. Many topics, awards, free ad space in periodical, society net, museum participation. Shack pics & QSLs welcome. Writers needed. SASE for info to RCSW, 32 Applegate, Bennington VT 05201. BNB197

SCHEMATICS: Radio receivers 1920s/60s. Send name, brand, model no., SASE. Scaramella, PO Box 1, Woonsocket RI 02895-0001. BNB214

HAM RADIO REPAIR, tube through solid state. Robert Hall Electronics, PO Box 8363, San Francisco CA 94128; (408)-729-8200. BNB219

HAM TRADER YELLOW SHEETS, in our 23rd year. Buy, swap, sell ham-radio gear. Published twice a month. Ads quickly circulate—no long wait for results. SASE for sample copy. $9 for one year (24 issues). POB 356, Wheaton IL 60189. BNB220

DX HEADING MAPS for Boston, NYC, Phila., Baltimore, Detroit, Atlanta, Chicago, New Orleans, Saint Louis, Dallas, LA. 11 × 17 $1.75 pp. 22 × 34 $5.95 pp. Specify city. Bill Massey W2HOJ, PO Box 397, Hainesport NJ 08036. BNB221

COMMODORE 64 CW INSTRUCTOR PROGRAM. Generates CW on TV speaker. Random code, keyboard input, or prerecorded "CW Tests." Character speed and spacing set independently. Designed for classes and increasing code speed. $15.00—diskette or cassette (specify). N7BCU, Dennis Olver, 22000 S. Tonya Ct., Beavercreek OR 97004. BNB249

QSLS to order. Variety of styles, colors, card stock. W4BPD QSLs, PO Drawer DX, Cordova SC 29039. BNB260

THE DX'ERS MAGAZINE. Up-to-date, informative, interesting. Compiled and edited by Gus Browning W4BPD, DXCC Honor Roll Certificate #4. Send for *free* sample and subscription information today. PO Drawer DX, Cordova SC 29039. BNB261

COCO OWNERS—Free software and hardware brochure. CoCoNuts, POB 9866, San Jose CA 95157-0866. BNB265

COMPREHENSIVE RTTY, ASCII, CW software package for TRS-80 models I/III/4. Free brochure. KCQ Software, 6319 Boeuf Trace, Alexandria LA 71301. BNB270

CASH PAID for traffic/speed radar equipment. Write or call: Brian R. Esterman, PO Box 8141, Northfield IL 60093; (312)-251-8901. BNB271

REPEATER VOTER: Four-channel expandable signal-to-noise voter card. The voter selects the best signal from the audio. Just give it COR and audio and it returns the best signal. All multiple-receiver repeaters should have one. Commercial design. For more information write: Voter, Hall Electronics, 815 E. Hudson St., Columbus OH 43211. BNB274

KENWOOD 430S owners only! Stop Scan—when the squelch breaks, the scan stops! Adjustable resume scan delay. No modifications! Kit $25, assembled $35. JABCO, R1 Box 386, Alexandria IN 46001. BNB275

WHY SELL IT? You can donate that unwanted equipment, get the tax break, and feel like a million. Contact the kids learning English via amateur radio at Junior High 22 on Manhattan's Lower East Side. WB2JKJ, Junior High School 22 ARC, 111 Columbia Street, New York NY 10002. BNB276

COPY SATELLITE PHOTOGRAPHS, weather maps, and press on our military-surplus facsimile recorders. Recorders are solid-state, dual-speed, and fully automatic. Catalog available. Atlantic Sales, 3730 Nautilus Ave., Brooklyn NY 11224; (718)-372-0349. BNB280

DIGITAL AUTOMATIC DISPLAYS for FT-101s, TS-520s, Collins, Swan, and all others. Six 1/2" digits in a 5" wide by 1-1/2" high and 9" deep metal cabinet. Send $1.00 for information. Grand Systems Dept. A, PO Box 3377, Blaine WA 98230. Canadians contact VE7LB. BNB282

ATLAS 350XL OWNERS GROUP. Free newsletter. Send QSL with rig s/n and SASE. Know people who repair them? Information to share? Questions? Rod N5NM, Box 2169A, Santa Fe NM 87501. BNB291

KNOW FIRST! You need the *W5YI Report*, a twice-monthly award-winning hot insider ham-radio newsletter. Acclaimed best! Confidential facts, ideas, insights, nationwide news, technology, predictions, alerts! Quoted coast-to-coast! We print what you don't get elsewhere! $21.00 annually w/money-back guarantee! SASE (2 stamps) brings free sample. *W5YI Report*, PO Box #10101, Dallas TX 75207. BNB294

NEW VE PROGRAM QUESTIONS—booklet contains the current FCC Amateur Radio Operator Study Guide and all 1600 *actual* test questions for *all* ham classes (Novice though Extra class). $3.00 postpaid. *W5YI Report*, PO Box #10101, Dallas TX 75207. BNB295

1985 "BLOSSOMLAND BLAST," Sunday, October 6, 1985. Write "BLAST," PO Box 175, St. Joseph MI 49085. BNB296

REPLACE rusted antenna bolts with stainless steel. Small quantities, free catalog. Elwick, Dept. 539, 230 Woods Lane, Somerdale NJ 08083. BNB297

NEW Grant AM/SSB CB with power mike, $125. R. D. Carter, PO Box 418, Vass NC 28394. BNB298

TI 99/4A random, text, keyboard, send, receive, code-practice programs. Dr. Code "General" sends International Morse Code and prints on screen; you choose speed, tone, which characters to be sent, spacing, and more! Dr. Code "Speech" is the same as "General," with speech; you choose how many characters before speech check. For cassette of both copyrighted programs and conditional copying privileges, send $10.00 plus $3.00 shipping and handling to N5ESF, Rt. 1, Box 1326, Lake Charles LA 70601. Phone (318)-436-2048, no collect calls please; satisfaction or money back. BNB299

THE KANSAS CITY DX CLUB invites all DX and contest enthusiasts to its 5th-floor Stouffers Hotel Hospitality Suite during this year's Dayton Hamvention. Continuous CW pileup contest, DX trivia contest, DX video room, and refreshments—Friday and Saturday starting at 7:00 pm. BNB300

ONTARIO HAMS. Fast repair of all types of amateur equipment. Specialize in complete overhaul and alignment. Equipment pickup and return via UPS. Ralph VE3UY, (519)-836-1735. BNB301

COCO AMTOR/RTTY/ASCII/CW. Full-feature software ROM pack for TRS-80C, $89. Matching clock/PTT controllers, $24. CW interface, $29, including airmail postage. Visa/Mastercard accepted. Requires conventional RTTY TU. Very popular in UK, newly available in US from England's top quality radio software house. Grosvenor Software, 22 Grosvenor Road, Seaford, Sussex BN25 2BS, England. BNB302

COMPLETE two-meter repeater with Advanced Computer Controls RC-850 controller, full telemetry, link radio, and many other extras for sale. Excellent condition. Doug Zastrow WB0UPJ, 1702 Alaska, Norfolk NE 68701. Phone (402)-379-3166 days, (402)-379-1166 evenings. BNB303

MAYBE THIS AD IS FOR YOU...Burglar Alarms...easily learned. Terrific employment-business opportunities. Get in now. Starting information $2. Security Electronics International, PO Box 1456-GX, Grand Rapids MI 49501. BNB304

SSB CRYSTAL FILTERS, 9.0 MHz, 2.4-kHz bandwidth, 6 pole, $17.50, two for $30.00. 4CX250B chimneys, $5.00, three for $12.00. ICL7117 LED DVM chips, $8.00, three for $20.00. Dentron CAP transceiver, 100 Watts, solid state, $275; ACPS, $85; GLA1000-C linear, 160–15 + 10, $285. All items new, postpaid, data. National receiver collection, SASE list. Wanted: automobile radio vibrators, new. W. E. Delage, PO Box 493, Northfield OH 44067; (216)-274-2012. BNB305

CODE-PRACTICE PROGRAMS diskette for IBM PC, PCjr. $10 pp. Andrew Modla/73, 5 Derby Place, Newtown PA 18940. BNB306

TUBES: Sell fifty-year collection—receiving and transmitting. Send list of requirements for availability and price quotes. M. Levy W5QJT, 4141 Krupp Drive, Apt. One, El Paso TX 79902. BNB307

FTDX400 TRANSCEIVER—200 Watts, excellent condition, with manual. Ideal for new ham or old-timer. Built like a battleship. Needs only TLC from owner. W1XU, Box 186, Peterborough NH 03458; (603)-924-6759. BNB308

HIGH-QUALITY, LOW-COST courtesy beepers for your transmitter or repeater. Kit $14, assembled $18 F.O.B. YBM Enterprises, 8502 N. Oketo Ave., Niles IL 60648. BNB309

FIND OUT what else you can hear on your general-coverage transceiver or receiver. Join a shortwave radio listening club. Complete information on major North American clubs and sample newsletter, $1.00. Association of North American Radio Clubs, 1500 Bunbury Drive, Whittier CA 90601. BNB310

ICOM 730, mint, guaranteed, $650. Computer hardware and software. Check our prices before buying. AVEX Computers, 2445 Cleveland Avenue, West Lawn PA 19609; (215)-674-9559. BNB311

HAM HELP

Does anybody have information on how to build a ferrite-bead antenna?

Marvin Rosen N3BOA
20 W. Madison Street
Baltimore MD 21201

I need 211 (311, VT4C) tubes and meters from a BC-375 transmitter.

Robert S. McMullen N0FVN
24 W. 58 Terrace
Kansas City MO 64113

Can anyone provide assistance or information in converting the HyGain 3750 to using the 6146 tube?

Also, I desperately need a 19-kHz crystal for the RCA stereo FM signal simulator model WR-52A. I will pay any reasonable price for the information.

Connie Mercer NG4C
403 Pershing Drive
WSMR NM 88002

SPECIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices, 73 Magazine, Pine St., Peterborough NH 03458.

KEARNEY NE
MAR 30–31

The Midway ARC of Kearney, Nebraska, will hold its 8th annual ARRL Spring Convention on March 30–31, 1985, at the Holiday Inn, Kearney NE. The Friday-night pre-activity will be the North American Teleconference Radio Network live from the Holidome. During the weekend there will be symposia on AMSAT, packet radio, and frequency coordination and RFI. There will be alternate activities for non-hams. There will be a banquet, Four Keys music, ventriloquism, Belvin B. Bump's humor, and more. For more information, contact MARC, PO Box 1231 Kearney NE 68847.

PUTNAM COUNTY IN
APR 6

The Putnam County Amateur Radio Club will hold its third annual auction and flea market on April 6, 1985, beginning at 8:00 am, at the Putnam County Fairgrounds, north of Greencastle IN. Admission for this all-indoor event is $3.00 per person and children under 12 are free. Flea-market tables are $2.00 each. Setup begins at 6:00 am. The auction will begin at 1:00 pm. Food and drink will be available. For more information, send an SASE to John S. Underwood K9IIB, RFD 1, Box 10, Fillmore IN 46128; (317)-246-6335.

KANSAS CITY MO
APR 13–14

The PHD Amateur Radio Association will sponsor the Missouri State ARRL Convention on Saturday and Sunday, April 13-14, 1985, from 9:30 am to 5:30 pm (both days), in the Trade Mart Building II, located at the downtown Kansas City MO airport. Registration is $4.00 (good for both days) and swap tables are $10.00 (for both days; includes one registration). Forums will include: ARRL, computer, FCC, VE, DX, PR, QCWA, and AMSAT. Homebrew and CW contests will also be held. Both the flea market and the commercial booths will be inside the 45,000-square-foot building. A banquet will be held on Saturday night at the Gold Buffet ($10.50). Talk-in on 146.34/.94. For further information or pre-registration, send an SASE to PHD Amateur Radio Association, PO Box 11, Liberty MO 64068-0011, or phone (816)-781-7313 or (816)-452-9321.

RALEIGH NC
APR 14

The 13th annual Raleigh Amateur Radio Society Hamfest will be held on April 14, 1985, at the Jim Graham Building, NC State Fairgrounds, Hillsborough Street, just west of the Raleigh Beltline, Raleigh NC. Admission is $3.50 in advance (until April 1) and $5.00 at the door. Flea-market spaces are $5.00 (includes a table and two chairs). Dealers can set up on Saturday, April 13, from 4:00 to 10:00 pm, and on Sunday, April 14, from 6:00 am to 8:00 am. There will be QCWA, MARS, and ARRL-NTS meetings, CW and home-brew contests, and ARRL and RARS booths. Talk-in on 146.04/.64 (W4DW) and 146.28/.88 (K4ITL). For pre-registration flyer or dealer information, contact Rollin Ransom NF4P at (919)-779-5021 or Jim Bradley WA4AOO at (919)-851-2437, or write to RARS, PO Box 17124, Raleigh NC 27619.

HOSARC 12TH ANNIVERSARY
APR 14

The Hall of Science ARC (HOSARC) will issue a commemorative certificate to anyone working a HOSARC station between 1500 and 2100 UTC on April 14, 1985. This special event celebrates HOSARC's 12th anniversary. Stations using WB2JSM will operate CW in the first 25 kHz of the 40-, 15-, and 10-meter Novice bands and in the first 5 kHz of the 30-meter band. Stations using WB2ZZO will operate in the first 25 kHz of the 40-, 20-, 15-, and 10-meter General phone bands. Send a QSL and a large SASE (40 cents or 1 IRC) to HOSARC, PO Box 131, Jamaica NY 11415, or to HOSARC QSL Manager Arnold Schiffman WB2YXB, 81-22 250th Street, Bellrose NY 11426.

WEST HARTFORD CT
APR 21

The Pioneer Valley Radio Association will hold its eighth annual flea market on Sunday, April 14, 1985, from 10:00 am to 4:00 pm, at Conard High School, Berkshire Avenue, West Hartford CT. Features include volunteer exams, lectures on computers and Basic programming, an auction, food, and free parking. Tables are $10.00 in advance and $12.00 at the door. Talk-in on 146.19/.79. For further information or for reservations, contact Jon Patz KA1FYL, 34 Whiting Lane, West Hartford CT 06119, or call (203)-232-8772 evenings.

BEDFORD PA
APR 14

The Bedford PA, Altoona PA, Somerset PA, and Cumberland MD Amateur Radio Clubs and the Blue Knob Repeater Association will sponsor the third annual Southern Alleghenies Hamfest on Sunday, April 14, 1985, from 7:00 am to 4:00 pm, at the Bedford County Fairgrounds, one mile west of Bedford on Route 30 and one half mile west of the Route 220 Bypass (close to the Bedford Exit of the PA Turnpike). Admission is $3.00, tables are $5.00, and outside tailgate spaces are $2.00. Dealers can set up the day before. Talk-in on 145.49/.89, 444.2 +5 MHz, and 146.52. For more information, contact Joel Cunard KB3TR, RD 6, Box 104, Bedford PA 15522; (814)-623-9697.

FRAMINGHAM MA
APR 14

The Framingham Amateur Radio Association, Inc., will hold its annual spring flea market on April 14, 1985, beginning at 10:00 am, at the Framingham Civic League Building, 214 Concord Street (Route 126), Framingham MA. Sellers can set up at 8:30 am. Admission is $2.00 and tables are $10.00 (which includes one free admission) and pre-registration is required. Food will be available. Talk-in on .75/.15. For more information, contact Joe Weiner K1VVC, 52 Overlook Drive, Framingham MA 01701; (617)-877-7166.

WOOD COUNTY WV
APR 14

The second annual NWWVRA Hamfest will be held on April 14, 1985, from 8:00 am to 4:00 pm, at the Wood County 4-H Grounds. There will be an all-indoor flea market and dealers are welcome. Admission is $3.00 and flea-market spaces are $3.00 each. There will be food and XYL activities. Talk-in on 147.360/.960. For further information, send an SASE to Jim Whitlatch, 5007 Elmwood Avenue, Parkersburg WV 26101, or call (304)-422-7157.

ARBOR DAY
APR 15–21

Special-event stations will be operating from Nebraska City NE, beginning at 2400 UTC on April 15, 1985, and ending at 0600 UTC on April 21, 1985, to commemorate Arbor Day. Nebraska City is the home of Mr. J. Sterling Morton, the founder of Arbor Day. All amateurs contacting these stations will be eligible to receive a commemorative certificate from the Nebraska City Amateur Radio Club. Stations will be operating in the General portion of the 80- and 10-meter phone and CW bands. SWLs can participate also. Send an SASE and your QSL card to Nebraska City Radio Club, PO Box 8, Nebraska City NE 68410.

SOMERSWORTH NH
APR 20

The Great Bay Radio Association will sponsor the Springfest 85 flea market/hamfest on Saturday, April 20, 1985, from 9:00 am to 3:00 pm, at the Somersworth Armory, Blackwater Road, Somersworth NH. Admission is $1.00 and tables are $8.00 (includes one admission). There will be food and free parking. Talk-in on 146.40/147.00. For table reservations or more information, write to Great Bay Radio Association, PO Box 911, Dover NH 03820.

GRAND JUNCTION CO
APR 20

The Grand Mesa Repeater Society will hold the sixth annual Western Slope Amateur Radio and Computer Swapfest on Saturday, April 20, 1985, from 10:00 am to 4:00 pm, at a location to be disclosed later, in

Grand Junction CO. Admission is free and tables are $5.00 each. Features include an indoor swapfest, exams, an auction, and refreshments. Talk-in on 146.82 and 449.200. For further information or to reserve a table, send an SASE to Larry Brooks W0ECV, 3185 Bunting Avenue, Grand Junction CO 81504; (303)-434-5603.

ROCHESTER MN
APR 20

The Rochester Amateur Radio Club will sponsor the 8th annual Rochester Area Hamfest on Saturday, April 20, 1985, beginning at 8:30 am, at John Adams Junior High School, 1525 NW 31st Street, Rochester MN. There will be a large indoor flea market, refreshments, and free parking. Talk-in on 146.22/.82 (W0MXW). For further information, contact the RARC, c/o WB0YEE, 2253 Nordic Ct. NW, Rochester MN 55901.

FLEMINGTON NJ
APR 20

The Cherryville Repeater Association will sponsor the Flemington NJ Hamfest on Saturday, April 20, 1985, from 8:00 am to 3:00 pm, at the Hunterdon County High School Field House, Route 31, Flemington NJ. Admission is $3.00. Breakfast will be available from 6:30 am. Exams will be given. Talk-in on 147.975/.375, 147.615/.015, 222.52/224.12, 449.850/444.850, and 146.52. For more information or for table reservations, contact Bill Inkrote K2NJ, RD 10, Box 294, Quakertown-Croton Road, Flemington NJ 08822; (201)-788-4080.

MADISON WI
APR 21

The Madison Area Repeater Association, Inc. (MARA) will host its thirteenth annual Madison Swapfest on Sunday, April 21, 1985, beginning at 9:00 am, at the Dane County Exposition Center Forum Building, Madison WI. Commercial exhibitors and flea-market sellers can set up beginning at 8:00 am. Admission is $2.50 in advance and $3.00 at the door. Children 12 and under are admitted free. Flea-market tables are $4.00 in advance and $5.00 at the door. There is parking available in the adjacent paved lot and hotel accommodations are available within walking distance of the swapfest. There will be a large variety of equipment and components for hams, computer hobbyists, and experimenters. An all-you-can-eat pancake breakfast and a barbecue lunch will be available. Talk-in on 146.16/.76. For reservations or more information, contact MARA, PO Box 3403, Madison WI 53704.

BRAINTREE MA
APR 21

The South Shore Amateur Radio Club of Braintree MA will hold an indoor flea market on Sunday, April 21, 1985, from 11:00 am to 4:00 pm, at the Viking Club, 410 Quincy Avenue, Braintree MA. Admission is $1.00 and 8-foot tables are $10.00 each (includes one free admission per table). For more information or to purchase tables (make checks payable to the South Shore Amateur Radio Club; there is no cancellation refund after April 17, 1985), contact Ed Doherty W1MPT, 236 Wildwood Avenue, Braintree MA 02184; (617)-843-4431.

DAYTON OH
APR 26

The Dayton/Cincinnati Quarter Century Wireless Association Chapter 9 will hold its annual banquet in conjunction with the OOTC and the Dayton Hamvention on Friday, April 26, 1985, at 7:30 pm, at Neils Heritage House, 2189 S. Dixie Drive, Dayton OH. There will be a cash bar beginning at 6:30 pm. Tickets are $12.50 per person. For reservations or tickets, contact Bob Dingle, Secretary/Treasurer, 657 Dell Ridge Drive, Dayton OH 45429; (513)-299-7114.

DAYTON OH
APR 26

The 16th annual B*A*S*H will be held the night of Friday, April 26, 1985, at the Convention Center, Main and Fifth Streets, Dayton OH. Admission is free to all. Parking is available in the adjacent City Garage. There will be sandwiches, snacks, and a cash bar. There will also be live entertainment. For more information, contact the Miami Valley FM Association, PO Box 263, Dayton OH 45401.

FITCHBURG MA
APR 27

The Montachusett Amateur Radio Association will hold a flea market on Saturday, April 27, 1985, from 9:00 am to 3:00 pm, at the Knights of Columbus Hall, Electric Avenue, Fitchburg MA. Admission is $1.00 and tables are $8.00 each. Sellers can set up at 8:00 am. Talk-in on 144.85/145.45 and 146.52. For table reservations or more information (make check payable to M.A.R.A.), contact Jim Beauregard, 7 Mountain Avenue, Fitchburg MA 01424.

WEBSTER MA
APR 28

The Eastern Connecticut ARA will hold its annual flea market on April 28, 1985, at the Point Breeze Restaurant on Webster Lake, near Exit One (Route 395) on Route 193, Webster MA. Talk-in on 147.225/.825 or .52 direct. For further information, contact either Dick Spahl K1SYI at (617)-943-4420 (after 7:00 pm), or Don Amirault K1APE, RR 1, Box 310, Thompson CT 06277; (203)-923-2727.

150TH ANNIVERSARY
SPECIAL EVENT
VICTORIA, AUSTRALIA

A special commemorative callsign, VI3WI, part of the 150th anniversary celebration of the European settlement in Victoria, will be on the DX bands until at least April 30, 1985. VI3WI will be activated on a roster basis by selected members of the Wireless Institute of Australia and its affiliated clubs. All DX bands and all modes will be used and a commemorative QSL is available, either direct or via the VK3 QSL Bureau. A special award certificate is also available for radio contact with Victoria between November, 1984, and April 30, 1985. Contact (SWLs log) one station in VK3 during the award period to qualify. A QSL card for the qualifying contact, endorsed with a congratulatory message on Victoria's 150th anniversary, plus $2.00 or equivalent, should be sent to Victoria 150 Award, Wireless Institute of Australia, 412 Brunswick Street, Fitzroy 3065, Victoria, Australia.

CEDARBURG WI
MAY 4

The Ozaukee Radio Club, Inc., will sponsor its seventh annual swapfest on Saturday, May 4, 1985, from 8:00 am to 1:00 pm, at the Circle B Recreation Center, Highway 60, Cedarburg WI (20 miles north of Milwaukee). Admission is $2.00 in advance and $3.00 at the door. Four-foot tables are $2.00 each and are available in advance only. Refreshments will be available. Seller setup begins at 7:00 am. For tickets, tables, maps, or more information, send a business-size SASE to 1985 ORC Swapfest, 101 E. Clay Street, Saukville WI 53080.

ROGERS AR
MAY 4

The Northwest Arkansas Amateur Radio Club, Inc., will hold its fifth annual hamfest/swapfest on Saturday, May 4, 1985, from 8:00 am to 4:00 pm, at the Rogers Youth Center, 315 West Olive, Rogers AR. Setup begins at 7:00 am. Admission is free, and commercial and flea-market tables are $2.00—first come, first served. Talk-in on 146.16/.76 and 146.52 simplex. For more information, send an SASE to either Ray Watson N5HAP, 714 Maple Drive, Springdale AR 72764, or to Dave Perry KE5QZ, 3201 N. 13th Street, Rogers AR 72756.

BEMIDJI MN
MAY 4

The Bemidji Amateur Radio Club will hold its annual hamfest/swapfest on Saturday, May 4, 1985, from 9:00 am to 4:00 pm, at the Middle School cafeteria, Bemidji MN. Licensing exams will be given. Talk-in on 146.13/.73. For more information, write

Jerry Pottratz, Bemidji Amateur Radio Club, PO Box 524, Bemidji MN 56601; (218)-751-7502.

COCHISE COUNTY AZ
MAY 4-5

The Cochise Amateur Radio Association (CARA) invites all amateurs to participate in the dedication ot the new CARA Training Facility and Range. The inaugural event for the complex will be a hamfest on May 4-5, 1985. A flea market is planned and tailgaters are welcome. The new facility is located 5 miles east of Sierra Vista AZ on Moson Road, off of Highway 90 East. For more information, contact the Cochise Amateur Radio Association, PO Box 1855, Sierra Vista AZ 85636, Attn: KB7HB.

GREENVILLE SC
MAY 4-5

The Blue Ridge Amateur Radio Society will sponsor the 46th annual Greenville Hamfest and Electronics Flea Market on Saturday, May 4, 1985, from 8:00 am to 5:00 pm, and Sunday, May 5, 1985, from 8:00 am to 3:00 pm, at the American Legion Fairgrounds, Greenville SC. Admission is $3.00 in advance and $4.00 at the gate. There will be licensing exams, a Wouff Hong ceremony, the South Carolina ARRL State Convention, 25,000 square feet of dealer displays, an indoor/outdoor flea market, a Saturday-night banquet, camping, and more. For advance tickets or for VEC exam information, write Mrs. Sue Chism N4ENX, PO Box 6751, Greenville SC 29606. For more information, contact Mr. Rancy Rice WD4ADK, 1401 W. Parker Road, Greenville SC 29611.

ROSEVILLE CA
MAY 5

The 13th annual Sacramento Valley Amateur Radio Hamswap will be held on Sunday, May 5, 1985, from 9:00 am to 3:00 pm, at the Placer County Fairgrounds, Roseville CA. Swap tables will be available. There will be food and free parking. Talk-in on 145.190 and 224.780 (K6IS repeaters). For ticket and table information, contact Carl Schultz KA6KWB, 2942 Gwendolyn Way, Rancho Cordova CA 95670; (916)-366-9111.

SANDWICH IL
MAY 5

The Kishwaukee Amateur Radio Club will hold its annual hamfest on Sunday, May 5, 1985, at the DeKalb County Fairgrounds, on Suydam Road just north of Route 34, between Routes 23 and 47. Admission is $2.00 in advance and $3.00 at the gate. Inside display tables are $5.00 each. All parking is free and there will be outside areas for tailgating. Overnight camping will be available (no hookups). Food will also be available. Talk-in on 146.94 and 146.13/.73. For more information or for tickets, write to KARC, Box 334, Sycamore IL 60178.

WEST SPRINGFIELD MA
MAY 5

The Hampden County Radio Association will hold a flea market on Sunday, May 5, 1985, rain or shine, from 9:00 am to 3:00 pm, at the Elks Lodge, Morgan Road, West Springfield MA (Morgan Road is approximately one-half mile south of the Massachusetts Turnpike on Route 5. Turn right onto Morgan Road at Abdows Restaurant and drive three-quarters of a mile to the Elks Lodge). Admission is $1.00 and tables are $3.00 each. Dealers may display from vehicles for $3.00 per vehicle. Refreshments will be available.

BATON ROUGE LA
MAY 11-12

The Baton Rouge Amateur Radio Club will hold its annual hamfest on Saturday and Sunday, May 11-12, 1985, from 8:30 am to 5:00 pm on Saturday, and from 8:30 am to 2:00 pm on Sunday, at the campus of Catholic High School, Baton Rouge LA. Admission is free. Featured will be a swapfest, forums, and new-equipment dealers. Talk-in on 146.79–. There will be VE exams (through Extra class) from 9:00 am to 12:00 noon on both days. There is a 30-day advance registration deadline for the exams. Send an SASE, Form 610, and a check for $4.00 payable to ARRL/VEC to George Perry W5LVX, 17424 Lady Constance, Greenwell Springs LA 70739. For further information, send an SASE to Rick Pourciau N5HHF, 879 Castle Kirk Drive, Baton Rouge LA 70808.

ARMED FORCES DAY
MAY 18

The 36th annual Armed Forces Day will be held on Saturday, May 18, 1985, from 1400 to 2200 UTC. ARS W4ODR, located at Naval Air Station Memphis, Millington TN, will be operated by active-duty, reserve, and retired sailors and Marines. Plans call for SSB operation on 7.230, 14.280, and 21.370 MHz (± 10 kHz). CW frequencies will be 21.145 and 28.145 MHz. 2-meter operation will be on 146.52 simplex. A special red, white, and blue certificate will be available to anyone who works W4ODR. No SASE is required. Calls not in the *Callbook* should QSL to: Military Club Station W4ODR, PO Box 54278, Naval Air Station Memphis, Millington TN 38054.

WIA 75TH ANNIVERSARY

The Wireless Institute of Australia, the world's first radio society, will celebrate its 75th anniversary during 1985. The WIA 75 Award will be available during the period from March 1, 1985, to December 31, 1985. To qualify, amateurs (and SWLs) need to contact (log) 75 members of the WIA. A contact will be valid only if the WIA member's individual membership number is logged. No more than 30 WIA members may be logged in any one callsign area. Send a log extract of the 75 members contacted and $2.00 (Australian) to WIA 75 Award Manager, Wireless Institute of Australia, 412 Brunswick Street, Fitzroy 3065, Victoria, Australia.

SATELLITES

USING THE AO-10 APOGEE PREDICTIONS

Apogee predictions for the month of April are provided for three sections of the United States: Washington DC at 39N 77W, Kansas at 39N 95W, and California at 38N 122W. Times are in UTC and apogee in this case is mean anomaly 128 rounded to the nearest whole hour. Use the chart as a guide in aiming your antenna, then fine-tune the azimuth and elevation values to peak the satellite's beacon signal. If you require more accurate orbital predictions, contact AMSAT at PO Box 27, Washington DC 20044.

AMSAT-OSCAR 10 APOGEE PREDICTIONS
APRIL 1985

			WASH		KANSAS		CALIF	
ORBIT	DAY	TIME	AZ	EL	AZ	EL	AZ	EL
1684	1	1200	136	36	118	24	98	4
1686	2	1200	133	31	116	18		
1688	3	1100	121	24	107	11		
1690	4	1000	111	16	98	3		
1691	4	2200					260	3
1692	5	1000	109	11				
1693	5	2100					253	13
1694	6	0900	101	3				
1695	6	2100			265	0	247	15
1697	7	2000			259	3	239	24
1698	8	1900	264	0	252	13	229	33
1701	9	1900	258	1	246	14	221	33
1703	10	1800	252	10	237	24	208	40
1705	11	1700	244	20	227	32	192	45
1707	12	1700	237	21	220	32	184	42
1709	13	1600	228	30	206	39	166	43
1711	14	1500	215	37	190	43	149	40
1713	15	1400	201	43	172	45	135	35
1715	16	1400	192	41	166	41	132	29
1717	17	1300	175	43	149	38	120	22
1719	18	1200	158	42	135	33	110	15
1721	19	1200	152	37	132	28	109	9
1723	20	1100	138	33	120	21	100	1
1725	21	1000	125	27	110	13		
1727	22	1000	123	21	109	8		
1728	22	2100					262	0
1729	23	0900	113	13				
1730	23	2100					257	1
1731	24	0800	104	6				
1732	24	2000					250	11
1733	25	0800	103	0				
1734	25	1900			261	0	242	20
1736	26	1900			255	1	236	22
1738	27	1800			248	11	226	30
1740	28	1700	254	7	241	20	213	37
1742	29	1700	248	8	234	21	205	37
1744	30	1600	241	17	224	29	190	41

HAM HELP

We are happy to provide Ham Help listings free, on a space-available basis. We are not happy when we have to take time from other duties to decipher cryptic notes scrawled illegibly on dog-eared postcards and odd-sized scraps of paper. Please type or print your request (neatly!), double spaced, on an 8½"×11" sheet of paper and use upper- and lowercase letters where appropriate. Also, please make a "1" look like a "1," not an "l," which could be an "el" or an "eye." and so on. Hard as it may be to believe, we are not familiar with every piece of equipment manufactured on Earth for the last 50 years! Thanks for your cooperation.

I need the following items for a Kenwood TS-520: CW filter, frequency counter, external speaker, and external vfo. I also need a book for a Tempo One.

Tony E. Byrum
320 N. Marion
Ottumwa IA 52501

I would like a copy or reprint of the June, 1983, *Ham Radio* article on using the XR-2211 and XR-2206 in a TRS-80 CoCo TTY interface. I will be happy to pay for copies and postage.

Peter St. Amaud
PO Box 8066
Lowell MA 01853

I need a copy of the schematic and owner's manual for a Hickock model 770A oscilloscope. I will gladly pay postage and copying costs.

James L. Monk W0JJL
2207 Madison Ave.
Norfolk NE 68701

I need a plug-in relay, Allied control number T154 CCC-CCC, 115 V dc, 9000 Ohms, contacts rated for 2 A at 29 V dc. It has 20 flat pins. This is for a National NCX-3.

Joe Karr KA5RKD
Route 1 Box 579
Lakeview AR 72642

I need to know the exact address and zip code of Precision Apparatus Co., Brooklyn NY.

Dick Haskin W6KEC
149 Mauna Loa Dr.
Monrovia CA 91016

I need a manual for the Collins R-390A receiver. I especially need the alignment instructions. I would also like copies of any improvements, modifications, etc., for this receiver. I would be glad to pay for copying charges and postage.

Robert L. Wood WA7DNN
PO Box 9474
Dededo, Guam 96912

I desperately need a schematic for a Gonset GSB-101 model 3262 linear amplifier. I will gladly pay copying costs and postage for any help.

Stephen Rehberg N6KZU
322 E. Mayfair Ave.
Stockton CA 95207

Please: Where can I beg, borrow, steal, or buy a 10 to 1 geared ratio drive with 1/4-inch shafts?

Russell L. Lawson K1MOU
124 South Grand St.
West Suffield CT 06093
(203)-668-2871

W2NSD/1
NEVER SAY DIE

editorial by Wayne Green

from page 4

JANUARY HAM CONFERENCE

The Ninth Annual Ham Conference met in Winter Park, Colorado, this January. In addition to discussions of potential solutions to the loss of high-tech career people which the fading away of amateur radio as a hobby has caused, there were demonstrations of some of the newest in microelectronics and ham gear.

The most impressive new piece of ham gear for me was the tiny new Kenwood HT. Incredible. And yet the tiny thing worked just fine when substituted for my now huge old 2400 Kenwood HT.

We gave the HTs a good workout, using them to keep in touch as we skied the whole range of trails at Winter Park, which is a good-sized ski area. For that application a lapel mike/speaker might have helped—I'll have to see if Kenwood has one available yet. Still, even with the HT in my parka pocket I had no problem hearing everyone clearly and talking with them just by squeezing my parka in the right place. It sure made people jump when I talked into my coat—and got answers.

FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

MEN WITH DREAMS

I don't know about you, but I just live for stories like this: According to Associated Press writer Norman Black, a gentleman by the name of Stanley J. Kaplan has been trying for many months to start a common-carrier service that would enable anyone to send brief radio messages "to the sun, the moon, any of the planets in our solar system, or any designated star outside the solar system."

Black writes, "For a $5.00 fee, Kaplan's Teleplanet Services, Inc., of Sudbury, Massachusetts, is prepared to help people 'reach out and break out of their earth-bound existence.' He says the publicity about his plans to transmit 'Space-Shot' messages has already produced a logjam of 175 orders."

Because Kaplan intends to transmit "binary digitized radio messages," he needs FCC approval, and "the FCC just doesn't seem to see this the way I do," Kaplan says. "It's not the average communications that they deal with. It's a dimension, really, that their rules aren't equipped for and I think they're afraid."

Early last September, the FCC announced it had denied Kaplan's request for "Special Temporary Authority to operate a common-carrier one-way paging station at Sudbury for the purpose of offering specialized extraterrestrial communications service to the public," adding that Teleplanet "has not demonstrated that there are extraordinary circumstances requiring temporary operations in the public interest. . ."

The FCC says it has reclassified the proposal as an application for development of Kaplan's idea, but, "I'm really pessimistic, quite frankly, that they're serious about letting it get off the ground," says Kaplan, who operates a company known as On-Page Enterprises, publishing trade newsletters for the telecommunications field.

Mr. Kaplan sounds like the sort of man who enjoys reading "Fun!," doesn't he? Anyway, who could ask for a better introduction to a column about "Men With Dreams."

ELEMENT 1
MULTIPLE CHOICE

1) One man with a dream was Stew Perry W1BB. His goal, which he achieved, was to:
   1) Work 100 countries on 160 meters
   2) Fly a radio-controlled airplane
   3) Work the USSR on 2 meters
   4) Accompany a DXpedition to XZ-land

2) Tim Chen BV2A/BV2B, currently well-known to DXers, was:
   1) The first winner of the ARRL's Worked All Continents Award
   2) The first licensed ham on Taiwan
   3) The first ham to operate from an airplane
   4) The first ham to operate from Kure Island

3) Father Moran 9N1MM is the only licensed ham in:
   1) Tibet
   2) China
   3) Franistan
   4) Nepal

4) Bill Smith W3GKP and Ross Bateman W4AO were the first hams to:
   1) Work Europe on 6 meters
   2) Bounce a radio signal off the moon
   3) Transmit slow-scan TV
   4) Jam a repeater

5) While certainly not a "man" with a dream, Ethel Smith W7FWB did contribute something important to ham radio. She founded:
   1) The Brass Pounders Award
   2) The Young Ladies Radio League
   3) The Quarter Century Wireless Association
   4) The Dayton Hamvention

ELEMENT 2
TRUE-FALSE

	True	False
1) Tom Christian VR6TC is the only licensed ham on Bermuda.	____	____
2) The original cubical quad antenna was designed for Ecuador's HCJB.	____	____
3) Don Norgaard W2KUJ is regarded as the "father" of the phasing method of generating SSB signals.	____	____
4) Owen Garriott W5LFL was the first ham to operate from space.	____	____
5) Stan Wright WA2DCS was the first ham to hear a "G" station on 6 meters.	____	____
6) Kenneth B. Warner W1EH was the first career employee of the ARRL.	____	____
7) 1AAW was the first US ham station to be heard in Europe.	____	____
8) The first amateur, two-way communications satellite was OSCAR 1.	____	____
9) At one time the ARRL was based in New York City.	____	____
10) W1AWW was the first VHF repeater.	____	____

ELEMENT 3
FILL IN THE BLANK

1) Horace Martin invented the ________.

2) ________ was the first Soviet amateur space satellite.

3) The first official ARRL station was ________.

4) Guglielmo Marconi was assisted in his first radio experiments by his brother, ________ Marconi.

THE ANSWERS

Element 1:

1—1 He was awarded 160-meter DXCC No. 1.
2—2 He uses BV2A on CW, BV2B on phone.
3—4 To the gratitude of DXers everywhere.
4—2 Project Moonbeam they called it in 1953.
5—2 In July, 1939.

Element 2:

1—False Try Pitcairn Island.
2—True Easy to build but hard to maintain.
3—True A helpful contribution to the hobby.
4—True An obvious question, but we couldn't leave this important "first" out of the column.
5—False British hams do not have access to 6 meters.
6—True The first of many to find a comfortable niche in the Hartford, Connecticut, area.
7—True And he was a bootleg operator.
8—False OSCAR III. OSCARs I and II were little more than space beacons.
9—True From 1917 to 1919.
10—True On 5 meters in 1932.

Element 3:

1—Vibroplex semiautomatic keyer ("bug").
2—Radio Sputnik 1 (RS1), in 1978.
3—W1MK.
4—Alfonso.

SCORING

Element 1:
Seven points for each correct answer.
Element 2:
Three points for each correct answer.
Element 3:
Eight points for each correct answer.

How did you do?

1-20 points—Blank mind
21-40 points—Blissful sleeper
41-60 points—Daydreamer
61-80 points—Man with a vision
81-100+ points—Dreams are made of this!

MAILBOX

Thanks to W0KXP/9 and N6DSA for noticing the error in Element 1, Question 2 of September, 1984's "Fun!" The official Conelrad frequencies were 640 and 1240 kHz, not 540 and 880 kHz, as my answer indicated. And no, the radio in my '62 Chevy isn't wrong, although I'll have to replace that burned-out dial lamp.

REVIEW

THE TU-1200 VHF/UHF RTTY INTERFACE

Of all the modes that amateurs operate, the one which has seen one of the most dramatic usage increases in recent years is RTTY (radioteletype). This upsurge in the popularity of RTTY can be correlated directly with advancements in both solid-state technology and the microcomputer industry. Many of the early microcomputer experimenters were also amateur-radio operators, so micros were in the ham shack before the microcomputer industry had even begun to explode.

Hams were quick to realize that the microcomputer, with its many interfacing capabilities, was ideally suited for use in RTTY. By replacing mechanical gears and reams of paper with integrated circuits and video monitors, RTTY was able to migrate out of the experimenter's basement and into the casual ham's operating station. Soon, radio magazines began to carry many advertisements for various interfaces that allowed the microcomputer and ham-radio transceiver to work together. It was these interfaces and the low-cost microcomputer that led to the increase in the popularity of RTTY.

J. A. Flesher Co. is one of the early manufacturers of computer/RTTY interfaces; in fact, their TU-170 has become a standard interface for many hams. Their latest RTTY interface, the TU-1200, is designed specifically for VHF and UHF operating. It is available in both kit and wired form, and I recently assembled and operated the kit version along with its wired counterpart.

Theory

The TU-1200 connects between a transceiver and an RS-232 or TTL-compatible terminal. In the receive mode, it detects the mark and space frequencies in the received audio. The mark and space frequencies are converted to digital signals which are outputted to the terminal using either RS-232 or TTL standards (determined by the terminal type). Once in the terminal, usually a microcomputer running terminal-emulation software, the digital signals are decoded according to the format being used (i.e., ASCII, Baudot). The terminal then sends the decoded characters to a monitor or printer, depending on how the system is configured.

In the transmit mode, the TU receives digital signals from the terminal and converts them to mark and space audio signals which are sent as AFSK (audio frequency shift keying) to the transmitter. Either way, the terminal unit must deal with digital signals, audio signals, and a conversion process.

Specifications

The TU-1200 measures 5-1/8 inches wide by 1-3/4 inches high by 6 inches long. There are three push-button switches and three LEDs on the front panel. They are, from left to right: Power, Send, and Normal/Reverse. (See Photo A.) The LEDs indicate power on, sending, and receive data available (RDA). The Power switch is used to turn the TU on, the Send switch is used to put the TU into the transmit mode, and the Normal/Reverse switch is used to invert the mark and space frequencies. Located on the back panel are a DB-25 female connector, a ground connector, and the power cord leading to the included 12-volt wall transformer.

The front panel, back panel, and bottom are dark beige and the top and sides are gray. The unit is aesthetically appealing and fits in nicely with the rest of the station.

As mentioned before, the TU-1200 is designed to operate on VHF and UHF frequencies. Because of this, the design and specifications differ from those of terminal units used on the HF bands. The TU-1200 is compatible with Bell 202 tones; its mark signal is low (1200 Hz) and the space is high (2200 Hz). Also, the unit incorporates a phase-locked-loop demodulator.

A PLL demodulator works by utilizing a phase detector along with a voltage-controlled oscillator (vco) in a feedback circuit. A dc feedback voltage is generated proportional to the difference in frequency between the received audio and the vco. This dc voltage will change as needed to adjust the vco to the same frequency as that which was received. Therefore, the dc voltage will vary as the input audio frequency alternates between mark and space conditions. This varying dc voltage is then filtered and amplified to produce the required mark and space signals.

There are several disadvantages to using a PLL demodulator. One is that they tend to lock onto the strongest signal in their lock range, often ignoring any weaker stations that you might be trying to copy. Another disadvantage is that a PLL has no variable tuning indicator, so it must be tuned by ear in conjunction with a single LED which lights when a signal is tuned in. However, these disadvantages are not important on the VHF and UHF bands because of the lack of interference and the absence of crowded conditions. In fact, the PLL works very well on the VHF and UHF bands.

Another consideration that the TU-1200 takes into account is the high baud rates that the VHF and UHF bands permit. The TU-1200 is designed to send and receive signals at up to 1200 baud while most TUs can go up only to 300 baud. To permit the higher baud rate, the TU-1200 uses Bell 202 tones in which the mark and space frequencies differ by 1000 Hz while the standard shift for the HF bands is 170 Hz.

The TU-1200 has been designed very well to take advantage of the opportunities available to amateurs on the VHF and UHF bands. However, because of its design it is limited to the VHF and UHF bands and will not work well on the HF bands.

As mentioned before, I assembled the kit version of the TU-1200. The unit arrived in excellent condition and a quick inspection of the parts revealed that everything was in order except for the absence of one nut, for which a replacement was easily found. The parts were separated by type and were very easy to account for. The ICs were shipped in a static-proof pouch, the resistors and other individual components were neatly sorted into manila bags, and the case was carefully wrapped in paper.

Before starting the actual construction, I glanced through the manual and found several changes noted on the included correction sheet. Several paragraphs had been rewritten and a few part values had been changed. One change is related to the printed circuit board included with the kit. (The same change applies to the board in the wired version I tested.) Because of a PC-board layout error, one end of a feedback resistor is connected to the wrong op amp of a dual-op-amp IC.

This error causes problems with the op amps, which are used to provide normal and reverse mark and space signals. However, the error is easily corrected by running a jumper wire on the PC board.

The unit took me one evening to assemble. The assembly went smoothly and no problems were encountered. After the assembly and initial testing, all outlined quite well in the manual, came the calibration of the mark and space frequencies. I used a frequency counter with a one-Hertz resolution for the calibration. (The wired version comes pre-adjusted and no calibration is required.)

Once the calibration was finished and the board was mounted in the case, the completed kit and the wired version were ready to be connected between a terminal and transceiver. However, because of the wide variety of computers and radios, the interfacing cables are not included with the TUs. A 25-pin male connector with hood is provided to get you started. Therefore, the next step in integrating the TU into the station was wiring the interface cables.

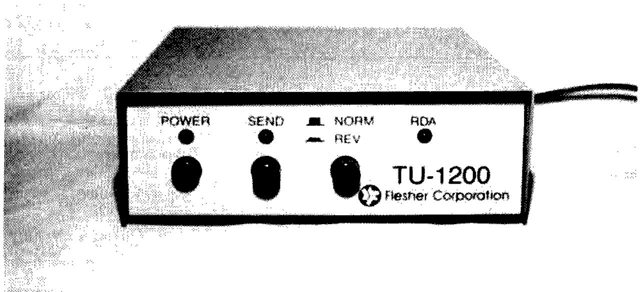


Photo A. The TU-1200 VHF/UHF RTTY interface from Flesher.

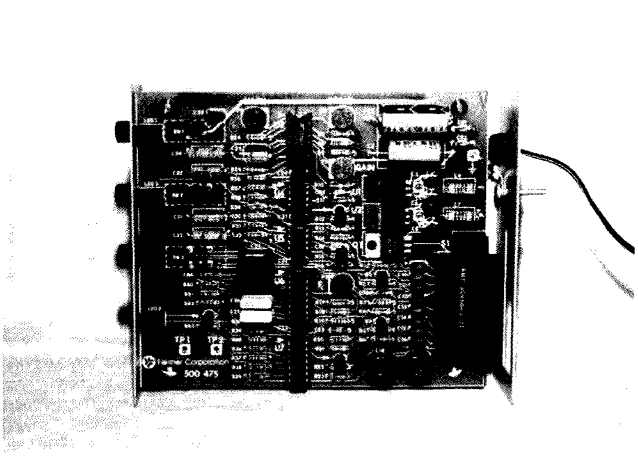


Photo B. The completed printed circuit board of the kit version.

Interfacing

Before starting any kind of wiring, consult the terminal/computer and/or software manuals, the transceiver manual, and the TU-1200 manual. The TU-1200 can accept and send both RS-232 and TTL-compatible signals through the DB-25 female connector located on the back of the unit. Find out which one the terminal/computer will accept and then consult the manuals for the proper wiring.

The connection of the transceiver requires two cables, one connecting to the transmitter's microphone jack and the other to the receiver's audio output. The TU can be used to operate the transmitter PTT if the current/voltage restrictions are met. Otherwise, an external relay is required to take advantage of the PTT. The audio output can come from the phone jack or the external speaker jack on the receiver. However, there is no provision for monitoring the received signal from the TU itself, as there is no external speaker jack.

The TU is capable of communicating using Baudot as well as ASCII at speeds of up to 1200 baud. The RTTY software should be capable of utilizing all these codes and speeds if full use of the TU's features is desired.

I wired the kit version of the TU-1200 to be used with an IC-271A two-meter transceiver and Kantronics Hamsoft for the TRS-80 Color Computer™. The Hamsoft program can operate only at 110 and 300 baud using ASCII, so I was not able to use the high-speed capability of the TU-1200. The assembled TU was wired for use with a Radio Shack TRS-80 Model 100 portable computer and an IC-02AT handie-talkie.

Operating

The most difficult part of the evaluation was finding a way to test the TU under actual two-way operating conditions. I was not able to locate a local amateur capable of operating RTTY using the Bell 202 standard. Because of this, I tested two-way operation of the TU by transmitting from the TRS-80C to the TRS-80 Model 100 under various conditions.

The TU acts very much like a regular telephone computer modem in half duplex, so I connected it to the RS-232 port of the Model 100 and used the Model 100's built-in telecommunications program. Because of this, however, I tested the unit only using ASCII code. A test message consisting of letters, numbers, and other symbols was stored in the TRS-80C for use during each transmission.

For the first test, I configured the two systems for simplex operation at 300-baud ASCII. Immediately after typing the transmit command on the TRS-80C, the Send LED on the TU-1200 lit, the PTT on the IC-271A tripped, and the mark and space tones could be heard rapidly alternating on the monitor speaker. Simultaneously, the RDA LED on the other TU-1200 lit and the Model 100's LCD screen displayed the test message as it was received. A comparison of the received text with that transmitted revealed that no errors had occurred during transmission or reception.

Next, I changed the speed to 110 baud and transmitted the message again. The message was received error-free once more. Now that I was sure the TUs and other equipment were operating properly, I tried a transmission over a longer distance. I transmitted through a local repeater at 300 baud and once again received perfect copy.

Throughout all the testing, the TUs worked perfectly and no problems were encountered.

The TU-1200 is a useful addition to any VHF/UHF station. Any application which requires the transmission of large amounts of data quickly and efficiently would benefit from the high-speed digital communications available from this unit. As the many new people in HF RTTY migrate onto RTTY in the VHF/UHF bands, an increase in the use of Bell 202 should occur.

The TU-1200 is a good buy, with the kit version selling for $99.95 and the assembled for $129.95. I found the people at Flesher to be very considerate and helpful, and I thoroughly enjoyed using the TUs. I see a bright future for the TU-1200 as more amateurs look to increase the capability of their RTTY stations on the VHF/UHF bands for use with high-speed satellite communications, computer-controlled mailboxes, RTTY nets, etc. The TU-1200 is another step in the continuing evolution of amateur radio and digital communications.

For more information, contact *Flesher Corp., PO Box 976, Topeka KS 66601; (913)-234-0198.*

Jonathan L. Mayo KR3T
Media PA

HAM DATA PROGRAMS FOR COMMODORE COMPUTERS

Some ham shacks are neat and orderly, but I have a suspicion that many of them are like mine—an unfinished project here, a piece of coax there. Somewhere buried in the rubble is a logbook. You remember—it's one of those things you used to be required by law to keep!

This haphazard approach to ham life is OK, at least until you decide you want to enter a contest or work toward one or more awards. Then it's time to drag out the paper and pen, perhaps a few shoeboxes for the QSLs, and make a commitment to order in your shack.

Computers seem made for people who hats paperwork. Sure, they can generate paper copies if you want, but in the meantime everything is stored in microscopically small electrons that respond only when you ask them to.

There's a multitude of logging programs available for the Commodore computers. One of the best is the Super Log series from Ham Data. There's something here for everyone, whether you own a VIC-20 with only 8K of expansion or a Commodore 64. Of course, the more memory you have available, the more OSO information you can deal with at one time.

The particular package I use is called Super Log IV and is available on disk only. It can be used on the VIC-20 with a minimum of 8K of expansion or on the 64. The features of Super Logs II and III are included.

So what does $23.95 for Super Log IV get you? Starting with a basic log entry, Super Log IV will compile an ongoing Worked All States summary and a complete DXCC summary. Provisions are even included for adding new countries.

Sorting is a task that computers handle well. With Super Log you can read or print your log by band or by date, find all the contacts you've had with people named Jim (a good name!), or any other unique field in the log entry.

Should you find yourself on the pileup end of the contacts, Super Log will print QSL labels for you with all the necessary information for a valid confirmation. All you do is stick them on the cards!

The program is broken into segments. Many of the special features require that the log be saved, the new segment loaded, and the log reentered before continuing. This can be somewhat inconvenient, but it allows greater versatility within the memory limitations of your machine. I want to make it clear, though, that the normal logging program is self-contained and doesn't require this maneuvering.

Regardless of whether you are using a logging program for hams or recipe files for the kitchen, computers are very picky about how things are designated. You cannot, for example, log some entries as being on the 7-MHz band and others as being on 40 meters and expect the program to find them all. Similar care must be taken with state and country designations. This limitation is not peculiar to Super Log; it is a result of computer technology.

If you are looking for some specific numbers, the C-64 version of Super Log IV will handle 525 files at a time. A new version handles 2000 entries per disk, but I haven't had a chance to try that one. On the other end of the scale, a VIC with 8K of expansion can handle 68 files at one time.

Are you mainly a contester? Contest Log is designed to handle both Sweepstakes and Field Day in approved ARRL format. For other contests there is a very versatile Universal Worldwide Log where you define the categories. A dupe checker, a necessity for contesters, is built-in. A twenty-four-hour clock is displayed on the screen at all times. Serial numbers are generated for you, too. I've used this one "under fire" and it does a good job.

Contest Log II has recently been introduced. It gives the 2000-entry-per-disk flexibility of Super Log V. I was happy to break the 1000 mark in Sweepstakes!

The programmer behind Ham Data software is Chip Lohman NN4U. He has taken a lot of time to create a good product. He also listens to feedback from his customers and has incorporated many of the suggestions submitted by them. Ham Data is proud of their customer service, and rightfully so. They are good people to do business with.

Ham Data also sells several other programs. Though not reviewed, Propagation Chart, Antenna Design, and Computer Morse (trainer) are also available.

Now, if you will excuse me, I need to get ready for the VHF contest. Let's see now, there's the two-meter amp—I think the 432 beam is still in the air. Hmmm. . .where did I put the Super Log disk. . .I know it's here somewhere!

For more information, contact *Ham Data, 3331 Bybrook Lane, Woodbridge VA 22192.*

Jim Grubbs K9EI
Springfield IL

LETTERS

I'VE GOT IT!

A conversation on 2 meters the other night prompted me to write you. In the past, as I'm sure you remember, you had to demonstrate your sending ability when taking the CW exam. For this you could use the FCC furnished key, or your own. Why not the same option for receiving CW?

You could use a microphone feeding a simple adjustable tone demodulator. This would in turn feed a small computer with a CW program. Of course, you would have to remember an extension cord to plug everything in! It would prove that not only can you copy CW, but that you can work with state-of-the-art equipment.

I do enjoy *73* very much. Keep up the good construction articles!

John T. Winkler WB3GPY
Wellsboro PA
(Howard K3CKB put him up to it.)

FUDDY-DUDDIES

Your editorial in the December, 1984, issue of *73* is right on! Although I may be guilty of some of these things around the edges, it is exactly what I have been preaching on the air.

On the air with many of my longtime friends I make no bones about what is happening. I tell them that it is not the young radio amateurs that are screwing up the bands. Just listen anywhere—all the old fuddy-duddies are the ones with their gain controls and compressors and finals cranked all the way to the right. The old fuddy-duddies are the ones that act as if they never heard of VOX. . .we call them the "over-to-you gang." The old fuddy-duddies ramble on and on and never think about IDing. If someone tries to modify their bad habits or crummy signals, they are the first to tell you how long they have been licensed or that the receiver is at fault.

Try to talk about design, construction, new ideas, computers, AMTOR, or packet—the fuddy-duddies tell you to move somewhere else. They are the same ones that were united against two-meter repeaters. They now are the ones timing out the repeaters without even giving their call.

Now for a brighter side: Listen to the young hams (yes, there are fewer and fewer). They are the ones that are coming up with state-of-the-art ideas. Where do you find them? On the two-meter repeaters. Very refreshing.

Anyone with an ounce of brains can see where amateur radio is headed. It almost seems too late now. I wish that your editorials would be required reading for every so-called old-timer.

Don Johnson W6AAQ
Esparto CA

DOWN TO EARTH

I loved your article, "Transistors: A Biased Approach" (December, 1984, and January, 1985). Having had a formal electrical engineering education, concentrated on theory, I appreciate the down-to-earth explanations. The rules of thumb are most helpful in starting any design. I hope to see an article or two on simple amplifier design in the future.

Guy Metrocavich
Morris Plains NJ

BATTLE PLAN

I just passed the Novice test and I found my instructor to be unreasonably lenient. I wondered why, and thought that maybe since amateur radio's popularity has declined, my instructor wanted to pass me to enlarge the number of hams. The next day I read your editorial and found that I was right. I was introduced to *the* cancer of amateur radio. There aren't enough newcomers, and therefore you (now I can say we) are at the mercy of the FCC—which needs our valuable radio space. Well, the work is cut out for us. New members. The FCC will not take away our radio space if we grow in numbers—or at least that is the last hope. I hate to say *last* hope, but that is the way you old-timers are thinking.

Yes, I am 17 years old and Morse code is the main reason I got interested in radio. If I want to use phone, I can pick up the telephone and call Uncle Larry in Connecticut. I am so attracted to Morse because when I call CQ and I get a reply from W1XXXX, I say "wow, I'm talking to someone way up in the northeast." I feel that excitement every time I call CQ.

You know how I got started? I saw dusty equipment in our high school in a small room. The electronics teacher is a Novice and helped me out and here I am.

So this is the battle plan—Publicity. I never knew hams were still around until the teacher told me!

Publicity and the numbers of people it can create will save us from the FCC. Yes, I am going to do my part at my school to recruit my share. How about you?

Jon Sinclair
Athens OH

MASS. CLASSES

The 19-79 Amateur Radio Association will sponsor evening classes for those interested in obtaining a Novice-, Technician-, or General-class license, beginning on March 19, 1985, at Chelsea High School, Chelsea, Massachusetts. The

cost will be minimal—class materials only. For more information, contact the 19-79 Amateur Radio Association, PO Box 171, Chelsea MA 02150. Please enclose your phone number.

19-79 ARA
Chelsea MA

SAY WHAT?

You asked for one reason, one convincing reason why CW is the most efficient use of our crowded radio spectrum.

To convince high schoolers, simply don't tell them about phone until after they're Novices—then let the cat out of the bag.

Japan's high-tech boom has cultural roots as well as no-code roots. The suicide rate there is very high.

I want to start a club at our high school. Any ideas?

Donald E. Fresh N9BAM/K9WAR
Lamar CO

Yep, and the teenage suicide rate in the US is one of the highest in the world—probably another area amateur radio could have made a difference.

Your plan for keeping it a secret that Novices aren't allowed to use voice might be difficult to implement. Of course, if we stick to those with an IQ of under 50 we have a chance—but then the prospect of increasing this contingent is dismaying to contemplate. We already have far too many of this group on our bands jamming nets, jamming repeaters, and making our CB bands sound like oases of calm.

Every time I read a letter from some ham worried about the ham bands being made worse—like the CB bands—I know he's a knee-jerk jerk who hasn't listened to either a ham band or CB in years.

If you want to start a ham club in your local high school, I suggest you meet with the principal and point out the benefits to the students. I suggest you plan to have it during school hours so you aren't up against busing, after-school sports, and union overtime requirements for teachers.—Wayne.

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

Somebody asked me the other day, "Just what do you cover in 'RTTY Loop'?" Short of the obvious answer, radioteletype, I paused for a moment. The view I have had of this column, and I hope you have, too, is that we look at the whole spectrum of digital communication over amateur radio. This month, in fact, we shall see two different facets of the picture.

A few months ago, we discussed AMTOR, the RTTY technique which allows error checking on a group of several characters at a time. With automatic requests for retransmission in the case of error, AMTOR can often get a message through in conditions which would prevent the exchange of conventional RTTY information.

Where AMTOR operates on a morsel of a few characters at a time, there is another technique growing in popularity that takes a different approach to error correction. To see what I mean, let's take a short lateral detour, then return to the main drag in a bit.

Those of us in the computer world have all been acquainted with, either directly or by reputation, various bulletin-board services. One of the prime functions of the bulletin board is program and text uploading and downloading, that is, the transfer of material between the user and the host computer. Early attempts at transfer of straight text, much in the way of "conventional" RTTY, often were thwarted by the occasional bit bungled by the communications circuit. Now, when you are sending a message or chewing the rag on RTTY, changing one letter may be little more than an inconvenience. Even if the message said MOVE instead of LOVE, you could probably figure it out. However, when transmitting a program, such an error could cause problems ranging from a Basic program not running to a machine-language program branching into a destructive sequence. Thus, some means of error checking was needed.

The system devised, and commonly in use to this day, was Ward Christensen's XMODEM protocol. In this scheme, the data is sent in groups of 128 bytes. Each block of data is preceded by a block number and followed by a byte called the "checksum," representing a simple method of error correction. If the receiving station does not receive the correct block, in order, or if the checksum it computes does not agree with the one sent, then a repeat is requested. The system has undergone refinements since its inception, but the basic principle remains the same.

An analogous scheme has been devised to move data over radio circuits. Called *packet radio*, this technique organizes the data into discrete packets which have integral addressing and error-checking information, much as the Christensen XMODEM blocks do. Each burst of data, called a "frame," contains:

- an opening flag byte
- an address field containing the address of the originating station, ultimate addressee, and any repeaters required in between
- a control field which identifies the type data contained in the frame
- an information field containing up to 256 bytes of data
- an error-checking field using the Cyclic Redundancy Check
- an ending flag byte

These packets are sent by RTTY techniques and are now in use in many areas at speeds of up to 1200 baud. I have spoken with some local amateurs involved with packet who assure me that techniques exist that, soon enough, will increase the speed by at least a factor of four, if not more!

We will have more on packet radio in future months. It promises to be as revolutionary as it sounds to on-the-air digital communication.

Now, as they would say aboard the *Enterprise*, hard to port and change course to 8504 mark 2, or something like that. Over the years, most regular readers have become acquainted with my love affair with the Motorola 68XX series of microprocessors. My latest love, of course, has been the Tandy TRS-80C Color Computer™. This 6809-based computer has capabilities far beyond similarly-priced microcomputers, only some of which have been yet realized. One of the key differences between the CoCo, as it is known, and larger 6809 systems is the lack of an expansion bus. Well, a new arrival here at WA3AJR has done much to correct that deficit.

The C-C Bus, a product of PBJ, Inc., is an expansion bus for the CoCo that allows up to six boards to be plugged into the CoCo at one time. These boards might be game cartridges, disk controllers, serial or parallel ports, real-time clocks, additional memory, or what have you. It features full buffering of all signal lines, RFI reduction, software selection of any slot, with slot-independent boards, such as ports, available at all times, and a built-in power supply. The availability of a power supply means that the newer CoCo2 will work with older accessories, which require the −12 volts that the CoCo2 does not provide.

To date, I have used the C-C Bus with several other PBJ boards, including their serial interface, parallel interface, real-time clock, and full 80 × 24 terminal board. I have not had enough time yet to tell you about each and every board, but I will, sooner or later. Not only that, but the capabilities of these boards are such that they appear to lend themselves very nicely to the design of RTTY programs.

CoCo owners might do well to drop PBJ a note at PO Box 813, N. Bergen NJ 07047, and tell them that you would like more information on the C-C Bus and other cards you read about in "RTTY Loop."

Remembering that I write this column about two to three months before publication, I can now comment on some of the responses I have been receiving to my questions on RTTY programs in use with various computer systems. Wow! There certainly is a variety. My hope is to accumulate data for a few months, then try to compile what I have collected into some semblance of order for presentation to you. For those who came in late, I am interested in what types of interfacing those of you running computers on RTTY are using, both hardware and software. To keep things straight, I have asked for one computer system a month, but it is not too late for those whose systems have been mentioned before to offer their two cents. To date, in January I asked for users of TI-99/4A computers to drop me a note, in February for Apple II/II+/IIe and clones users' input, and last month for Commodore's VIC-20 and C 64 owners to write. This month, let's hear from all the TRS-80 Z-80 crowd, that is, the TRS-80 Models I, III, and 4. As for the rest of you, hang on and I'll get to you in due time. All I ask is that you drop me a short note, card, or whatever telling me what kind of computer you are using, what kind of hardware and software interfacing you are using, and what you think of it, pro or con.

Another popular item requested in the mail has been the reprints from the past editions of "RTTY Loop." I have put together a bunch of them, with information gleaned from the early days of the column and from other sources. Rather than list them here, drop me a note with a self-addressed, stamped envelope to the address at the head of the column, and I will be happy to send you back a list of what is available.

It is from comments sent in with these requests and the like that I get a feel for what you all are interested in. For example, Gail F. Moulton, Jr. WA6KJD wanted to know more about packet radio. The first half of this month's column is an answer to that request. Let me know what you think, and I shall try to keep this column responsive to your needs; and look for my answer to you in the mail, or here, in the pages of "RTTY Loop."

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

CONNECTICUT QSO PARTY
Starts: 1100 UTC April 13
Ends: 1100 UTC April 14

Sponsored by the Candlewood ARA, the Connecticut QSO Party includes a required rest period from 0500 to 1000 UTC on April 14. Phone and CW are to be considered the same contest.

EXCHANGE:

RS(T), QSO number, ARRL section or CT county.

FREQUENCIES:

Phone—3927, 7250, 14294, 21370, 28540; CW—40 kHz from low end; Novice—3725, 7125, 21125, 28125.

SCORING:

Club station W1QI counts 5 points, Novice QSOs count 2 points, OSCAR QSOs count 3 points, others 1 point each. CT stations multiply QSO points by ARRL sections worked. CT stations may work DX stations for QSO points and one extra multiplier. Others, multiply QSO points by number of CT counties worked.

ENTRIES:

Include an SASE for results and mail entries by May 5 to: CARA, c/o R. Dillon N2EFA, Box 143, Bethel CT 06801.

QRP ARCI SPRING SSB CONTEST
Starts: 1200 UTC April 20
Ends: 2400 UTC April 21

Stations may be worked once per band for QSO points. Participants may operate a maximum of 24 hours during the contest period.

EXCHANGE:

Members—RS, state/province/country, and QRP ARCI membership number; non-

CALENDAR

Apr 13-14	Connecticut QSO Party
Apr 20-21	World Fishing Contest—Vigo '85
Apr 20-21	QRP ARCI Spring SSB Contest
Apr 27-28	Helvetia Contest
May 4-5	Florida QSO Party
May 4-5	Late Spring QRP SSB Activity Weekend
May 28-28	CLARA Ac/Dc Mystery Contest
Jun 8-9	Worldwide South America CW Contest
Jun 8-9	ARRL VHF QSO Party
Jun 22-23	ARRL Field Day
Jul 1	CARF Canada Day Contest
Jul 13-14	IARU Radiosport Championship
Jul 20-22	CQ VHF WPX Contest
Aug 3-4	ARRL UHF Contest
Aug 17-18	New Jersey QSO Party
Aug 17-18	SARTG Worldwide RTTY Contest
Sep 14-15	ARRL VHF QSO Party
Sep 14-16	Washington QSO Party
Sep 28-29	Late Summer QRP CW Activity Weekend
Oct 5-6	ARRL QSO Party—CW
Oct 12-13	Rio CW DX Contest
Oct 12-13	ARRL QSO Party—Phone
Oct 19-20	ARRL Simulated Emergency Test
Nov 2-3	ARRL Sweepstakes—CW
Nov 16-17	ARRL Sweepstakes—Phone
Dec 7-8	ARRL 160-Meter Contest
Dec 14-15	ARRL 10-Meter Contest

NARC
December 1984
RADIO
NEWSETTE
Volume 5, No. 12

NEWSLETTER OF THE MONTH

Only rarely have we mentioned newsletter logos here. Oddly, newsletters sporting fantastic artwork often fall short in their editorial content, and vice versa. This month's winner, however, makes the grade in both departments. The *NARC Newsette,* chronicle of the Nittany Amateur Radio Club (PA), veritably sparkles.

Richard Sine KB3WN is the editor of this fine publication, assisted by Richard Thompson K3BIE. Richard writes a wonderful column, "Boring Interesting Entertaining," that takes a look at ham activities on all fronts: local, national, and international. The most recent issue features a review of a new ham-oriented book, tips on emergency operation, and plenty of witty filler from the editor. Also present are the usual meeting announcements, items for sale, and paid advertising. In all, a very impressive package.

To enter your club's newsletter in *73*'s Newsletter of the Month Contest, send it to *73* Magazine, 80 Pine Street, Peterborough NH 03458, Attn: Newsletter of the Month.

RESULTS

14th SARTG WORLDWIDE RTTY CONTEST, 1984

World Top Scores, Single Operator

1st	SM6ASD	262,105 points
2nd	DJ6JC	220,320 points
3rd	HB9HK	208,670 points
4th	I4JXE	192,800 points
5th	OZ1CRL	178,620 points

Top USA Scores, Single Operator

9th	KT1N	91,140 points
13th	W8MQK	65,145 points
14th	WA7EGA	47,580 points
17th	W2KHQ	40,635 points
20th	W3KV	32,375 points

Top Multi-Operator

HA5KAG	139,725 points

members—RS, state/province/country, and power output.

SCORING:

Each member QSO counts 5 points regardless of location. Nonmember QSOs with the same continent are 2 points—with different continents, 4 points each.

Count each state, province, and country as a multiplier once per band. USA and Canada do not count as countries, only states and provinces.

Power multipliers are as follows: 4-5 Watts output, ×2; 3-4 Watts output, ×4; 2-3 Watts output, ×6; 1-2 Watts output, ×8; less than 1 Watt output, ×10.

Entries from stations running more than 5 Watts output will count as check logs only. The highest power used for any contact on any band will determine the multiplier to be used for scoring the whole log.

Stations are eligible for the following bonus multipliers: If 100% natural power (solar, wind, etc., with or without storage), ×2. If with storage, storage cells must be charged by the natural power source within 48 hours preceding the start of and/or during the contest. Battery power, ×1.5. No other source of power may be used at any time during the contest to qualify for these multipliers.

Final score is total QSO points times the states/provinces/countries multiplier, times the power multiplier, times the bonus multiplier (if any).

FREQUENCIES:

1810, 3985, 7285, 14285, 21385, 28885, 50385. No 30-meter contacts will be counted.

AWARDS:

Certificates to the highest-scoring station in each state, province, or country with 2 or more entries. Entries automatically considered for annual Triple Crowns of QRP Award. A special MILLIWATT certificate is being sponsored by WØRSP for the highest-scoring station in the less-than-1-Watt category, provided there are two or more entries in that power category.

LOGS AND ENTRIES:

Separate log sheets are suggested for each band for ease of scoring. Send full log data, including full name, address, and bands used, plus work sheet showing details and time(s) off air. No log copies will be returned. All entries desiring results and scores please enclose a large envelope with return postage or two IRCs. It is a condition of entry that the decision of the QRP ARCI Contest Chairman is final in case of dispute. Logs must be received by May 21 to qualify. Send all logs and data to QRP ARCI Contest Chairman, Eugene C. Smith KA5NLY, PO Box 55010, Little Rock AR 72225.

WORLD FISHING CONTEST— VIGO '85

Starts: 1000 UTC April 20
Ends: 1500 UTC April 21

This event was organized in honor of the celebration of the World Fishing Exhibition in Vigo, Spain. The contest will use all bands, 80 through 10 meters—SSB only. Operating classes include (a) single operator, all bands and (b) multi-operator, one transmitter only.

EXCHANGE:

RS report plus *CQ* zone number.

SCORING:

Count a multiplier for each different DXCC country contacted. The same station may be contacted on different bands but will only count as one multiplier. A contact with station EH1WFE in Vigo is an extra multiplier.

Each contact between stations on different continents is worth 3 points. Contacts between stations on the same continent but different countries are 1 point each. Contacts between stations in the same country are allowed for country-multiplier credit but have zero QSO-point value.

The final score is the result of the total QSO points multiplied by the sum of your country multiplier.

AWARDS:

The first-place entry in category (a), single operator, will receive an all-expenses-paid trip to Vigo, Spain, from the participant's country of origin. The trip will be for a duration of six days in the month of September, 1985, and the winner will visit the World Fishing Exhibition, VIGO '85. He will be considered a special guest of the Exhibition and as such will be presented with a commemorative plaque in honor of his achievements. During the six-day visit to Vigo, various events will be organized in his honor, events such as sightseeing and visits to different places of interest in the area.

The first-place entry in category (b), multi-operator, will receive a trophy for the station and a certificate for each of the operators.

First-place awards will be given for each category in each participating country. In countries or sections where the returns justify, second- and third-place awards will be made. To be eligible for an award, a single-operator station must show a minimum of 10 hours of operation or 100 QSOs minimum.

All certificates and awards will be issued to the licensee of the station used. The World Fishing Contest Committee has the right to increase the prizes without prior notice.

ENTRIES:

Logs must show all times in UTC, all sent and received exchanges, and indicate country multipliers only the first time worked. Logs must be checked for duplicate contacts, correct QSO points, and multipliers. Submitted logs must have duplicate contacts clearly shown.

Each entry must be accompanied by a summary sheet showing all calculations, the entrant's address in block letters, and a signed declaration that all contest rules and regulations for amateur radio in the country of operation have been observed. Use a separate log sheet for each band. Sample log and summary sheets are available upon receipt of a large self-addressed envelope with sufficient postage or IRCs.

All entrants are required to submit a cross-check sheet for each band on which 200 or more QSOs are made. For each duplicate contact that is removed from a log by the contest committee, a penalty of three additional contacts will be subtracted.

Violation of amateur-radio regulations in the country of the contestant, violation of the rules of the contest, excessive duplicate contacts, or unverifiable QSOs or multipliers may be grounds for disqualification. Actions and decisions of the World Fishing Contest Committee are official and final.

All entries must be postmarked no later than May 31 and addressed to World Fishing Contest Committee, PO Box 833, Vigo, Spain.

NEW PRODUCTS

CAGEN CONTEST LOG

CaGen Software has released its new Contest Log program, designed for the Commodore 64 with disk drive and optional printer. The CaGen Contest Log is a rapid-action, machine-language program that eliminates duplicate contest QSOs and prints permanent contest logs and dupe sheets.

Because of its universal design, the program can be used for all contest situations, allowing duplicate checks by callsign alone or by callsign, band, and mode. A single disk file will log and check up to 2500 contacts, completely eliminating the need for paper logs or dupe sheets.

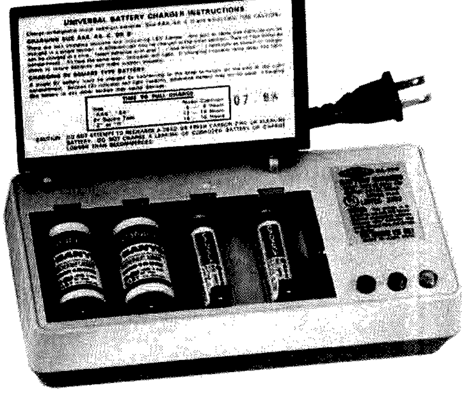
A fully-loaded log of contacts can be dupe-checked using callsign, band, and mode in 2.6 seconds. If the check is only for duplication of callsign, the same number of contacts is checked in less than one second.

The CaGen Contest Log will not allow a duplicate contact to be entered. Instead, it visually notifies the operator and then automatically resets for input of another callsign. Rapid logging is ensured, since the operator enters only callsign and exchange information. Date, time, band, mode, and QSO serial number are automatically entered as each contact is logged. Each entry is permanently written on the disk and power losses will not destroy the log.

A 24-hour clock is continuously displayed and retains its accuracy at all times, since it is not affected by disk read/write activity. The screen is designed to provide a constant display of contest status, showing the number of contacts logged, the time, and the current band and mode of operation. In addition, the QSO rate (contacts/hour) can be displayed at any time. This computation is updated with every log entry and adjusts itself automatically for break times of 30 minutes or more.

Other features include the ability to recall and display any entry by call or by serial number and an update mode which enables the operator to change or add to any log entry whenever necessary.

The print routines will produce a complete contest log and dupe sheets. Dupe sheets can be separated by band and mode or they can be printed as a single



Ultima's new nicad charger.

listing of all contacts, regardless of band or mode.

The CaGen Contest Log provides menu-driven selection of all program choices. While a separate help menu is available for display, the screen always shows all option codes during contest operation.

For more information, contact *CaGen Software, 4821 Rosecroft Street, Virginia Beach VA 23464.*

ESCI PLL DIGITAL SYNTHESIZER

Electronic Systems Consultants, Inc., has announced the availability of a single-board PLL digital frequency synthesizer. The board is designed to be used with a microcomputer as the controller and tunes from 5.0–5.5 MHz in 100-Hz steps. The plug-board construction has edge fingers which match with the well-known STD bus pinouts.

The module is one in a series which will be introduced to allow a complete intelligent HF synthesized station to be constructed by interconnecting the modules.

For more information on this module and future availability of the series, contact *Electronic Systems Consultants, Inc., PO Box 1105, Smithtown NY 11787; (516)-361-8142.*

ULTIMA NICAD BATTERY CHARGER

Ultima Electronics' new low-cost UL-100 battery charger can recharge up to 4 nicad batteries at one time for just pennies a day.

Ultima's UL-100 battery charger is fully automatic and can never overcharge your batteries. It features three separate charging sections which accept 2 or 4 pairs of AAA, AA, C, or D cells, or one pair of cells and one 9-V battery at one time.

Two convenient LED indicator lights monitor battery pairs in each charging compartment to determine proper charging. A third LED indicates single 9-V battery status. Indicator lights that fail to go on warn the user to check battery polarity for loose contacts.

For further information, contact *Ultima Electronics, Ltd., 21 Central Drive, Farmingdale NY 11735; (516)-752-0144 or (800)-645-9607.*

CETEC VEGA DTMF MODEM

Cetec Vega's new I-733 DTMF/RS-232C modem converts received DTMF messages to ASCII and converts ASCII messages from a computer's RS-232C serial port to DTMF. Incoming and outgoing messages are fully buffered to allow high-speed block data transfer, greatly simplifying applications software.

The I-733 is easily adaptable to a wide variety of applications, including computer-aided dispatch systems, integrated dispatch and status-monitoring systems, message logging to printer, disk, or remote display, remote data entry, and computer-supervised status-monitoring and control systems. With appropriate programming, virtually any computer can be interfaced via the I-733 to an existing or new DTMF system.

Pocket-sized multimeter from Non-Linear Systems.

Demonstration software for using the I-733 with an IBM Personal Computer or an Apple IIe computer is included at no extra cost, either on a 5-1/4-inch diskette or in document form. This software is written in Basic and may be used as the basis for a customized program. Source code is provided.

For additional information, contact *Cetec Vega, 9900 Baldwin Place, El Monte CA 91731.*

NON-LINEAR SYSTEMS POCKET-SIZE MULTIMETER

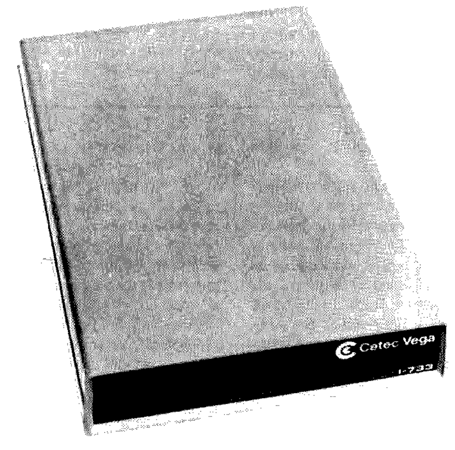
The AP-105 Digital Multimeter is a low-cost, 3½-digit multimeter that can be used just about anywhere electrical measurement is needed. Besides ac and dc voltage measurement, the AP-105 incorporates seven additional functions including dc current, conductance, resistance, NPN and PNP transistor, diode, and battery test. A single, convenient rotary switch selects on-off power, function, and 23 different ranges.

The AP-105 measures 4.8" × 2.8" × 0.9" and weighs only seven ounces. It also uses a large 0.5" LCD readout with high-contrast numbers. In addition, automatic polarity and overload indication are included. The multimeter is powered by a nine-volt transistor-radio battery with a life of 300 hours. A low-power indicator is also provided.

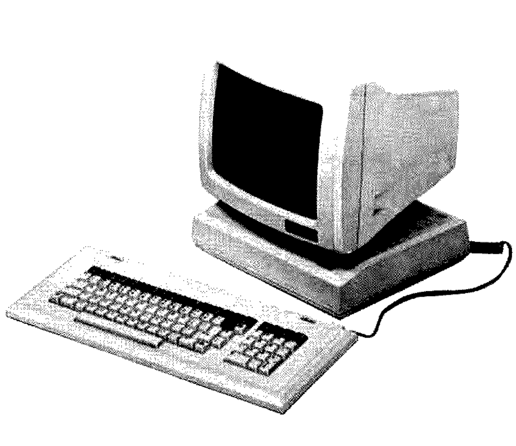
NLS product information is available by writing *Non-Linear Systems, 533 Stevens Avenue, Solana Beach CA 92075.*

HEATH Z-22 TERMINAL

The new Z-22 Monochrome Terminal is now available from Heath Company, one of the world's largest manufacturers of



Cetec Vega modem converts DTMF to ASCII.



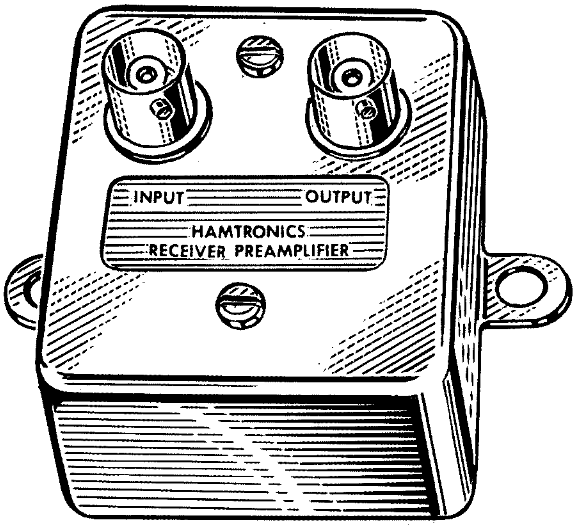
Heath's Z-22 monochrome terminal.

electronic kit products. The assembled and tested Z-22 provides comfortable and easy operation to the user along with built-in flexibility to satisfy both business and personal needs.

The Z-22 Terminal offers user-programming of automatic logons to information services and programmable function keys. Ergonomic features include a low-profile detachable keyboard with a 75-key standard QWERTY-type layout and an 18-key auxiliary keypad. The 12-inch monitor, featuring Zenith's special Chromgold II phosphor, tilts and rotates.

The CRT displays 25 rows of 80 characters, 24 rows of regular data plus a 25th status row. The terminal displays a 96-character set including upper- and lowercase, numbers, and punctuation. Three sets of graphics are also displayed which include 33 graphics characters, 33 Zenith graphics characters, and 33 foreign characters. The cursor can be set as a blinking or non-blinking character, or blinking or non-blinking underline.

The Z-22 Terminal is just one of many computer products offered by Heath Company in the latest Heathkit Catalog. To receive this colorful catalog free of charge, write *Heath Company, Dept. 150-495, Benton Harbor MI 49022.* In Canada, write *Heath Company, 1020 Islington Avenue, Dept. 3100, Toronto, Ontario M8Z 5Z3.*



The LNG-800 receiver preamp from Hamtronics.

VOCOM AMPLIFIERS

VoCom Products Corporation of Prospect Heights, Illinois, has recently announced a new line of continuous-duty rf amplifiers for fixed-base and repeater operation. The amplifiers complement the company's line of mobile rf amplifiers.

The 19-inch rack-mounted amplifiers are available for 50- and 100-Watt-output applications at UHF and VHF frequencies. The controlled 50-Ohm output impedance and low noise-figure design make these units ideal for congested repeater sites where amplifiers may be required to operate into highly-tuned loads.

Available options include logic-addressable bypass for emergency power saving operation, a high-efficiency ac power supply for 100- or 220-volt operation, and 12-volt emergency backup operation in the event of ac line failure.

An information sheet is available by writing to *VoCom Products Corporation, 65 East Palatine Road, Prospect Heights IL 60070; (800)-USA-MADE.*

HAMTRONICS® 800-MHZ RECEIVER PREAMP

Hamtronics, Inc., recently announced an 800–960-MHz version of its popular GaAsFET preamp. The LNG-800 preamp features a dual-gate GaAsMESFET with built-in diode protection against static discharge damage. The unit has 11 dB of gain with a 1.5-dB noise figure. It is easy to install, operates on 13.6 V dc, and measures only 2 × 2 × 1½ inches.

For complete information on the LNG preamps, as well as other VHF and UHF equipment such as transmitter and receiver modules, repeater controllers, autopatches, and DTMF controllers, write to *Hamtronics, Inc., 65-F Moul Rd., Hilton NY 14468-9535.*

COMPUTERIZED OSCILLOSCOPE

Rapid Systems has announced their Digital Oscilloscope Peripheral for IBM, Apple, and Commodore personal computers. The peripheral simply plugs into the personal computer, the supplied disk slips in, and the personal computer becomes a digital oscilloscope, ready to go to work.

Rapid Systems' new peripheral provides a powerful digital oscilloscope; the personal computer provides intelligent control and analysis. The system is a 4-channel digital oscilloscope, with a 2-MHz sampling rate, 500-kHz analog bandwidth, and diode protection on all inputs. The graphics display is color-enhanced, using up to 138 × 288 pixels for data display (up to four traces) and four lines of text for initial (default) values of the scope's parameters. Menu-driven operation provides keyboard control of gain parameters for channels A, B, C, and D, time base values, number of channels, and trigger mode. Plus, all the post-processing capabilities of the personal computer are available to store and retrieve waveforms from disk, to analyze and process the information, and to compute and word process.

Information on the Rapid Systems Digital Oscilloscope Peripheral is available from *Rapid Systems, 5415 136th Place SE, Bellevue WA 98006; (206)-641-2141.*

DX

Chod Harris VP2ML
Box 4881
Santa Rosa CA 95402

APRIL IS DX MONTH

April provides plenty of excitement to the deserving DXer. Although the sunspots and propagation have not provided the thrills of previous years, there is still enough DX on the bands to keep all but the 250+ country types glued to their radios. And even the diehard DXer will want to join in this month's activities.

Clipperton

Starting off the DX month of April is a major DXpedition to Clipperton Island, in the Pacific. Clipperton DXpeditions are few and far between, so don't miss this chance to put one of the rarer amateur-radio countries "in the log."

Clipperton Island (FO0) currently sits in the 20th spot on *The DX Bulletin*'s annual survey of most-wanted countries. Clipperton has moved steadily up that list since the last amateur-radio signals were heard from the isolated island in 1978.

The island itself is a tiny atoll due south of Monument Valley, Arizona, off the Mexican coast. The atoll is officially part of French Polynesia, although it lies fully 2500 miles from the nearest inhabited island in that country. The atoll is so flat that the DXpedition needs good navigation simply to locate the spot.

Clipperton sits about 800 miles from Acapulco, Mexico, and it is from Mexico that the 16 or more operators will depart for Clipperton in late March. The DXpeditioners expect to arrive on April 3, and stay about 7-8 days. As with any expedition of this magnitude, there is always the chance of unforeseen delays.

In fact, this same group attempted to get to Clipperton last year. Their chartered ship failed to arrive in Mexico, leaving the operators stranded. This year the group has arranged for more reliable transportation, in the form of a 115' sport-fishing boat. The boat and crew have been to Clipperton previously, a real plus on this trip.

This additional reliability is not without its price, and this Clipperton DXpedition will cost more than $50,000. Needless to say, any financial contribution individual DXers and DX clubs can make toward this trip will be greatly appreciated. Any contributions should be sent to the major sponsor of the trip, the Northern California DX Foundation, c/o Rusty Epps W6OAT, 948-H Kiely Boulevard, Santa Clara CA 95051.

Clipperton's location should mean good radio propagation into the United States. Sitting directly south of the western US and surrounded by water, Clipperton is a fine radio location. Its scarcity on the radio bands stems from the reluctance of the French officials to grant landing permission to all but the best-equipped DXpeditioners. Way back in the 50s, a couple of hams, including W0DX, former president of the ARRL, got stranded on Clipperton during their attempt to activate the rare radio location. The Coast Guard and others were called in to rescue the hams. Since then, Clipperton sees amateur-radio activity only once every few years, as demand builds until a dedicated group of amateurs puts together the detailed plans necessary for a successful, and safe, trip to the island. (A similar situation occurred on privately owned Palmyra Island a few years ago, and the owners have been very reluctant to have hams visit the island since. Not to mention the pirates, but that is another story!)

Let's all hope that nothing stands in the way of a highly successful, and safe, 1985 Clipperton DXpedition. And be sure to check your antenna and rig before the beginning of April, because if you miss Clipperton this time, it will be many years before your next chance. (Thanks to Clipperton DXpeditioner Kip Edwards W6SZN for his assistance.)

International DX Convention

Do you want to hear the Clipperton story firsthand, from the operators themselves? Join your loyal DX editor and many hundreds of DXers from around the world at the International DX Convention, April 19-21, at the Fresno (CA) Center Plaza Holiday Inn.

This convention is one of the highlights of the DX year and is the largest such annual DX convention. In addition to hundreds of west-coast DXers, many other amateurs from around the country and around the world converge on central California each April. Forced out of its former home in Visalia (where the heck is Visalia?) by its rapidly growing size, the International DX Convention features DX news, forums, presentations, and the usual barroom bragging sessions. See you there!

Dayton Hamvention

As if that wasn't enough for one month, April also features the Dayton Hamvention. More DXers get together at Dayton, Ohio, than at any other single event. And even then DXers can get lost in the crowd, as over 20,000 hams gather for the spring ritual that is "Dayton." You can bet members of the Clipperton gang will be there, as well as many other DX notables. The sign-in sheets at the many DX-oriented open houses around Dayton often read like Who's Who in DX.

The Dayton flea market is always good for a pair of tired feet, even if none of the assorted boat anchors, surplus components, or just plain junk catches your eye. And the commercial exhibits feature the latest in everything—an equipment junkie's delight. Doctor DX™ was first seen at Dayton, and many amateur-radio manufacturers debut new products in the overcrowded exhibit area.

If you haven't made your Dayton plans already, there's still time to do so before the gates open on April 26. Contact the Hamvention at Box 44, Dayton OH 45401, and check with the housing organizers at Box 1288, Dayton OH 45402. The DX clubs' hospitality suites are where the action is in the evenings. Check out the Kansas City DX Club's annual blast. (Now there's a DX club that knows how to mix DX with having a good time!) Another one to catch is the Southeastern DX Club's suite. Try Room 325 at Stouffer's. (The Southeastern DX Club will be promoting their DXPO in Atlanta this September 27-29. Save the dates.)

THE TERMINATOR IS COMING

Looking for something to brag about at the DX gathering? Tired of working Clipperton again? Try the "terminator." Neither the Grim Reaper nor the little whatsit at the end of your coax, the terminator is the imaginary line between sunlight and darkness: twilight. Right at sunrise and sunset, radio propagation often improves dramatically. In these days of less-than-ideal sunspots, every little advantage helps, so perhaps it's time you started working with the terminator.

The terminator, or gray line, passes your station twice each day, at sunrise and at sunset. Let's look at what happens to the ionosphere overhead at local sunset. The ionization caused by the sun's radiation gathers in several layers during the day. The highest of the layers useful for amateur-radio DX communication is the F-layer. Most long-haul DX is via refraction within the F-layer. This layer tends to dissipate soon after local sunset, however, and the higher-frequency bands close down for the night.

A lower layer of the ionosphere which affects radio propagation is the D-layer. This layer actually absorbs much of the radio signal and helps short-range communication at the expense of long-haul DX.

However, at sunset, the D-layer quickly falls apart, more quickly than the F-layer. For a short period of time, right around local sunset, you have good long-haul communications, without the weak signals and absorption found during the middle of the day. A somewhat similar process, in reverse, gives good signals at sunrise, too.

In addition to this enhanced propagation, other, poorly understood, things happen to radio signals around sunset (and sunrise). The terminator seams to "duct" signals long distances, without losing strength. The combination of these changes in the ionosphere is often super propagation, for a few minutes.

The improvement over "normal" propagation can be incredible! Signals can come up 40-60 dB in seconds and fade just as fast. But during that short time, Wow! What DX!

It's easy to take advantage of the terminator—just be on your radio at local sunrise and sunset. Your local newspaper probably has the sunrise and sunset times for your hometown. Tune around the bands starting about a half hour before the termination. This will give you a feeling for what is on the band and how strong the signals are. Then you'll be able to tell when the enhanced propagation starts. It doesn't make much difference what band you choose; all benefit from the terminator or gray line. Try different bands on different days, or switch (quickly) from one to another. When you hear signal strengths begin to increase, start calling CQ or call some DX station in a pileup. And keep your logbook handy!

The terminator effect varies with your latitude, or distance from the equator. For once in amateur radio, those in the *higher* latitudes get a break: The gray line lasts much longer the farther from the equator your station is located. This is caused by the angle the sun makes against the horizon as it sets. Near the equator, the sun sets straight down. Anyone who has ever visited tropical countries cannot help but notice how quickly the day turns into night. Up in the higher latitudes, however, twilight drags on for hours. (Above the Arctic Circle, it can last for days!)

So DXers in Florida, southern California, and Texas won't gain as much from the benefits of the terminator as those DXers brave enough to endure the wilds of the north country: New England, the Pacific Northwest, and W9/0. In fact, those of us unfortunate enough to live in the Caribbean get only minimal gains from the terminator.

At the higher latitudes, the gray-line effect lasts much longer than at latitudes nearer the equator, but the effect is less obvious. In the tropics, the gray line provides only fleeting moments of great DX, but those moments are well worth the effort to get out of bed early.

Case in point: I was up well before dawn at my home in Montserrat, in the West Indies. The local weather net convened soon after sunrise, and I was all tuned up on 75 meters. (When you live in the hurricane belt and own radio antennas, you spend a *lot* of time monitoring the weather!) The amplifier was off; no need for power to talk to the locals. Way in the background I could just hear H44DX, from the Solomon Islands, running W6s. Sunrise approached.

Suddenly H44DX's signal strength began to build. S2, S4, S6, over S9! on 75 meters! Even without the amplifier, I tossed my call into the pileup. Back he came, "VP2ML, this is H44DX. Boy are you loud! What are you running?" Almost as fast as I apologized for running 100 Watts into a low dipole, the signal strengths began to ebb. H44DX faded away into the noise. As soon as I signed, KV4FZ, amplifier fan noise in the background, with a huge 75-meter vertical ground plane sticking into the Caribbean, jumped on the frequency and called H44DX. He called and called. Nothing. H44DX had disappeared completely.

I don't get many chances to beat out Herb KV4FZ on 75 meters, but thanks to the terminator, I have Solomons confirmed on 75 before he does.

Those at higher latitudes won't have as

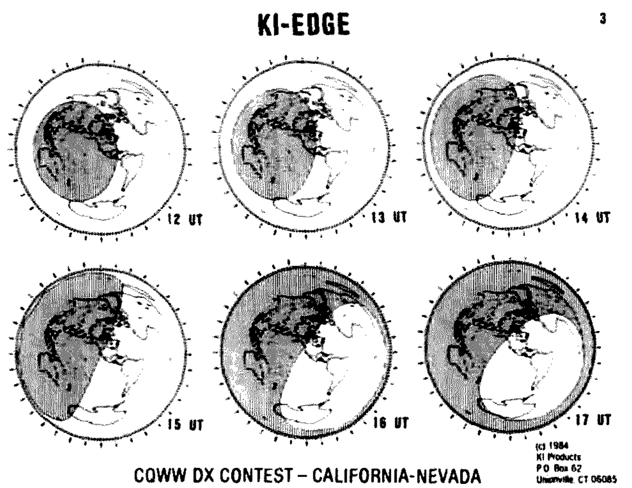


Fig. 1. The KI-Edge, terminator, or gray-line, indicator.

dramatic a difference, but the difference will be real, nevertheless. The terminator can give you that extra edge you need to make contacts when others can't.

The terminator works both ways. Not only do you enjoy enhanced radio propagation at local sunrise and sunset, but so, too, does the DX station. His signal strength will increase at your location when it is sunrise or sunset at his QTH. This means you can take advantage of the terminator regardless of local time.

The trick is to know the sunrise and sunset times at various places around the world. Your local newspaper will not list terminator times of Moscow, for example. Two relatively inexpensive ways to determine when the sun will rise or set at any place in the world are the DX Edge and the KI-Edge. (The first is a registered trademark of Xantec, Inc., the latter is copyrighted by K1KI.)

Both of these DX aids graphically depict the sunlit and dark portions of the earth, at various times of the day, at various days of the year. By setting the DX Edge for the correct time/date, or looking at the current KI-Edge, the DXer can see exactly where the terminator falls—what countries lie along that line of enhanced radio propagation.

Both DX aids are reasonably priced; less than $20 will cover the costs. The DX Edge includes a map of the world and a series of overlays for each month. You set the current UTC time with the correct month, and presto!, there's the terminator line. The KI-Edge is specific for each location and month and benefits contesters more than DXers, but a complete set of the entire year is still cheap. And the KI-Edge features a Great Circle projection centered at or near your QTH, much more familiar to hams than the Mercator map of the DX Edge. For more information on these DX operating aids, send a self-addressed, stamped envelope to: the DX Edge, PO Box 834, Madison Square Stn., New York NY 10159, or KI-Edge, PO Box 82, Unionville CT 06085.

No matter which DX aid you use, the results are the same. You look at which countries will fall under the terminator when you are on the air. Either send a directional CQ or listen specifically for stations about to pass under the terminator. You can compare two consecutive hours on the KI-Edge, or move the appropriate overlay to the next hour with the DX Edge, to see the direction of movement of the sunrise or sunset line.

Does it work? In a word, yes. You have a better chance of contacting a station when the terminator passes that station's location than at any other time. You can take advantage of the gray-line effect, even if the other station knows nothing about the terminator. Just be on an appropriate band at the right time, and listen in the right direction.

How well does this work? From personal experience, I can testify that following the terminator is well worth the DXer's while. One of my most memorable experiences in DXing was staying up all night to work Russians on 75 meters, as the dawn terminator swept across Asia.

Thanks to the organizational efforts of an active German amateur, I spent an enjoyable night running Russian stations from VP2ML, on 3642 kHz. As the sun rose over each consecutive country, the signal strengths of the stations in that country would rise up out of the noise, and I would work them. Dozens and dozens of stations from rare Russian countries, all lined up for their chance at Montserrat on 75. And all I had to do was stay on frequency and wait for the propagation boost of the terminator. Hour after hour I worked across the continent, filling page after page of the logbook, and giving many Russian stations their first 75-meter contact with Montserrat. It was a night well spent.

While you might not be able to duplicate this performance (the FCC frowns on stateside phone operation on 3842 kHz, and the US is not quite as rare on the bands as VP2M), anyone can enjoy the enhanced propagation of the gray line. Just pay attention to the sunrise/sunset times at the other end as well as your end. And good DXing!

BE MY GUEST

Guest Editorial by Marc Stern N1BLH

HEADS IN THE SAND

The other evening, as I was listening to a repeater, two pieces of information cropped up. The first was a notice of a possible renewal of the attack on 220 MHz and the second was about the 20-kHz two-meter repeater spacing which seems to be creeping across the country. Do you know which of the two elicited the most comment? The two-meter band plan, of course.

The operators on this repeater reflected a "head-in-the-sand" attitude which isn't uncommon, but which is hard to understand in this day of increasing attacks on our spectrum.

Like it or not, we've been big losers recently. The Federal Communications Commission has taken 80 MHz of frequency at 2310 MHz, it has proposed taking away our 5 MHz at 220, and we're in danger of losing 1 MHz of the 160-meter band. Yet, what do most of us talk about? Two-meter repeater spacing. It's a juxtaposition of priorities which makes us wonder just how effective we will be at defending ourselves in the future, if our hobby is to have a future.

Let's face it, the old attitude of "I don't operate there, so I don't care" has to be put on the same shelf with the spark gap. Anytime there's an attack on our frequency spectrum, we all suffer because there are many other frequency-hungry radio services out there literally lusting after our spectrum. And when these services see that we don't put up much of a struggle for our spectrum, they assume it's open season (or will be) on our band space. Don't think it can't happen because it already has. And as more and more bandwidth is needed for information transfer, we will probably feel more pressure.

This isn't to say we can't defend ourselves, because we can. We have proved it in the recent past with the no-code proposal. The outpouring of comments on this proposal showed that we didn't want it and the FCC agreed. So, you can't say we can't have any impact. Yet, looking objectively at the no-code proposal, we see that it too is an example of the myopia that is prevalent in the Amateur Radio Service today. Many operators who opposed no-code did so because they had the attitude that "if I had to do it, so should they." Others believed it was a filter to help keep our bands clean. Yet, this was a shortsighted attitude because once the issue passed from the scene, the army of amateurs crept back into the woodwork, proud it had defeated this issue. Amateurs seemed happy they had met and bested this "ultimate challenge" to our "rights" and they went back to their rag-chews on 75 or 40 CW, oblivious to changes which were spelled out in various footnotes to the WARC-79 agreement.

Those footnotes spelled out the challenges we are now facing. But where is the army of amateurs now? They are still sitting on 75 or 40, talking about nothing in particular or QRMing DX stations or announcing to all that this is "their frequency" and everyone else can get off it.

Does this sound like a harsh indictment of our fraternity? It is, and it's one we deserve. When was the last time you cared enough to follow up on a pressing issue with the FCC? If you're like probably 99 percent of the operators in this country, the answer is years ago. As long as no one gores your ox, you don't care. But let someone come along with a new proposal for changed spacing on two meters and heaven help them. You get up in arms. Meanwhile, the other services chip away at our frequency spectrum and you do nothing about it.

Granted, we have an organization in Newington that is representing us in the halls of power, but that one organization can only do so much, especially in the face of high-powered lobbyists representing commercial interests—the very interests that would like to see amateur radio as extinct as the dinosaur. They would dearly love to get their hands on all of our spectrum so they could put it to good use—as they define good use—making money out of it. They would like to take this precious public resource and make us pay to use it. After all, isn't that what any resource is for, they ask?

And the FCC, with the new Commissioners appointed in the last few years, is backing them up rather than supporting the amateur community. Why else would they even be thinking of taking away 220 or part of 160? The commercial interests have more clout than we have. Yet, we keep our heads in the sand and say nothing will ever happen. But it will and already has.

We are at a crucial point in our history. Recent figures point to a slowing in the growth of the amateur population. Other figures point out that the amateur population is aging and young operators aren't coming into the hobby to help increase our numbers.

There are some operators who would applaud this because they say our bands are already too crowded and we have to keep the number of licensees down. But those operators are just exhibiting the same kind of myopia as the ones who believe "it can't happen here." However, with an aging amateur population and a slow replacement rate, it won't be too long before there are fewer and fewer hams talking to one another.

When this happens, the commercial interests will pounce. They're waiting in the wings, just hoping for us to falter. And they may have good reason on their side. If anyone were to listen to what is going on during amateur QSOs or on our bands today they'd be sorely tempted to take our spectrum away from us. Just listen on 75, 40, or 20 any day and you'll hear jamming, obscenity, QRMing, poor operating techniques, and more. You'll hear people proclaiming their "rights" to this or that frequency and you'll hear ugly pileups on non-rare DX. While all this is going on, we point to our vaunted self-policing. Yet, since this is the situation that does exist, where is that self-policing? If this type of operation is allowed to continue, it won't be long before the commercial interests win out.

We know that hams are anything but saints. As in any portion of humanity, we have people with different thoughts, allegiances, styles. We are only human and do get angry at times, but we must show restraint and good operating practices. We must also continue to provide public service and experimentation, two of our primary reasons for existence.

We can't just hold onto the technology of the past. Wideband AM had its place, and there are still those diehards among us who think that single-sideband operation is just a passing fancy. These diehards prefer to AM away, while ignoring the realities of technology. The same is true of "narrowband" FM. Sure, our deviation is actually 5 kHz and our channel spacing is 15 kHz, but there are more efficient modes in the offing, such as amplitude-compandered sideband (ACSB), which should help ease congestion on our frequencies. But are we experimenting with it in large numbers? The answer is no. There is some experimentation, but without widespread examination of this and other modes, we lose one of our primary reasons for being.

Again, our current thinking places our heads firmly in the sand at a time when they must not be. We must experiment. There are exciting new modes available: spread spectrum, packet radio, ACSB, and more. We must be the leaders in using and proving them as we were years ago when radio was in its developmental years. We can't allow technology to pass us by.

We must also encourage growth and vigor in our hobby and increase the number of young people on our bands. When we do we will grow and remain a force to be reckoned with.

But ultimately we must defend ourselves. We must use our current base to defend ourselves against encroachments on our frequency spectrum. We can't just worry about our own set of operating likes and dislikes. We must think beyond our own horizons and respond to various FCC actions within a short time of their occurrence. We must follow amateur issues closely and provide the kind of support the folks in Newington and in the publishing field need. They are our vanguard, but we must be the soldiers in the field. We must comment. We must contact our legislators. We must act on every issue affecting us. If we don't then we will all lose.

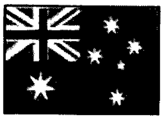
It's time to take our heads from the sand and look at what's really happening. Let's end the QRM and petty repeater squabbles. Let's stop worrying about power measurements and holding onto archaic modes. It's time we awoke to the threats to our fraternity. If we were to do this, we would be able to fend off attacks. Just imagine the clout of 400,000 amateurs in the halls of power: It's an awesome prospect. But if we don't do this, if we don't mobilize our resources, then it is likely we will lose in the end. It's happening now and we must wake up to it.

Marc Stern N1BLH, a journalist by trade, stays active in amateur radio as an ARRL Emergency Coordinator and as editor of the FraminghHam Circuit.

73 INTERNATIONAL

Each month, 73 brings you ham-radio news from around the world. In this collection of reports from our foreign correspondents, we present the latest news in DX, contests, and events, as well as keep you abreast of the technical achievements of hams in other countries.

If you would like to contribute to your country's column, write to your country's correspondent or to 73 Magazine, Pine Street, Peterborough NH 03458, USA, Attn: Perry Donham KW1O.



AUSTRALIA

J. E. Joyce VK3YJ
44 Wren Street
Altone 3018
Victoria
Australia

THE WIA

Our early Australian amateur-radio experimenters, with great foresight, knowing that the best way to expand knowledge in any particular field of endeavor is by sharing with others of similar vocation their thoughts and ideas, soon realized that some national forum was needed. With this in mind, they founded the Wireless Institute of Australia, the doyen of National Radio Societies.

Founded in 1910, the WIA is easily the oldest national radio club in existence, with the RSGB (1913) and ARRL (1914) following closely behind. Not a bad effort for an isolated country that had been colonized by Europeans (mainly convicts and their guards, sent out from England) only 130 years previously.

Our 75th Year Celebrations

This year the Wireless Institute of Australia is celebrating its 75th year of service to amateur radio, not only locally but worldwide, as the voice of Australian amateurs. As stated in earlier columns, there will be a great range of activities on all bands and modes of transmission this year to mark this special event.

The WIA is a combination of eight self-governing bodies which are companies registered under separate State Corporate Affairs Acts, and, as such, are responsible for the running of amateur radio within their own division. Each division then has a councillor on our federal body, which is responsible for the decisions made on an Australia-wide or international basis. The WIA has all the usual facilities and services to members that most other good national radio societies have, e.g., QSL bureaus, club rooms, etc., plus a monthly magazine sent free to all members.

The magazine is called *Amateur Radio* and is similar in format and quality to *73* except that it has an average of only 60 pages, but as this magazine is sent free of charge to all members monthly, even overseas members, this alone makes the $A35 annual subscription to be a member of the WIA seem more than fair, considering that the commercially-printed magazines of this size available here are around $A2 or more each, per month, plus postage costs. The WIA also publishes a yearly *Callbook* that covers all VK plus P29 call areas. This is a comprehensive callbook that has 70 pages of callsigns with another 20 pages allocated to suppliers of amateur equipment in our area. The final 76 pages are of good-quality information, covering most things concerning amateur radio in Australia, from repeaters to an electromagnetic interference checklist, DX hints, AMSAT operating, etc.

Several of the WIA state divisions conduct slow Morse-code practice sessions on the air, with the VK2 and VK5 sessions on 3.550 MHz (give or take QRM) at 0930 UTC onwards, seven nights per week, being the most popular in the eastern states. There is usually a different instructor each night, and with some sending stories or jokes as part of the practice session, this makes you concentrate so that you don't miss the punch line; it makes interesting listening. Others send the usual mixed letter and figure groups at speeds between 3 and 16 wpm.

The WIA (VK3 Division) started a nightly broadcast on 200 meters for the amateur-radio fraternity in 1921. This led to what is now a weekly event nationwide. Sunday morning is the time of most WIA broadcasts of local and federal news on most amateur bands. Each division has its own times and frequencies of operation, but a typical time slot would be between 9:30 and 11:00 local state time, with frequencies around 3.600 MHz, 7.050 to 7.150 MHz, and 14.175 MHz (VK6 and VK5), 21.175 and 21.195 MHz being of interest for DX operators. There are also 2-meter FM transmissions via repeaters in most states plus, lately, a trial transmission on 6 meters in VK3.

Perhaps the best way to gauge the worth of a national body representing its members is to ask what kind of relationship it enjoys with its members and with the authorities. In this regard, the WIA is held in high esteem by our DOC, so much so that we are left basically as a self-regulating body with an Amateur Advisory Committee responsible for the behavior of fellow amateurs on the air. The Committee, consisting of a group of amateurs and a DOC representative, monitors all amateur bands. If any amateur transmissions are found lacking in quality, the Committee sends out notices to the offending station, asking it either to explain or clean up operating procedures or quality. If no notice is taken of this friendly request, it then goes to our DOC, which then takes official action if it is deemed appropriate.

But the greatest worth, I feel, is the united front presented on all amateurs' behalf. Some of the latest cases where the WIA has been successful in this regard are—

- The granting of third-party traffic with consenting countries (e.g., America and Canada, with more in the pipeline)
- The introduction of a Novice-grade license
- The abolition of the 30% import duty on amateur gear, reintroduced for a short time last year
- The granting of WARC bands as soon as they become available, plus extra frequencies on the recognized amateur bands
- The abolition of the need to keep logbooks

The list is endless.

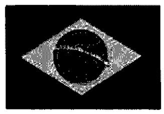
My Opinion

The WIA, to me, is like a trade-union movement, with its members paying for services rendered (e.g., better wages, better working conditions, legal representation, and liaison with the government of the day).

This poses a question. How many people, outside a union movement, refuse that extra $10.00-per-week raise, or the extra benefits that the union members get for them via their donations to an organization presenting one voice, for the betterment of all? Conversely, how many nonmembers of a national radio organization representing them refuse to use the added advantages gained by that organization on behalf of its members? E.g., larger frequency allocations, no log books, the fight against tower height limitations, representation to the DOC to eliminate spectrum anarchy on the bands, etc., etc.?

We all believe in freedom of choice in our democratic system, but we should also believe in every person pulling his fair share of the load. I feel sure that if these nonmembers had to fight the battles that organizations like the WIA do on their behalf, on an individual basis, they would be the first to stand up and shout "Why isn't something being done?" They are very lucky that members of organizations like the above are not so shortsighted.

Happy 75th birthday, WIA!



BRAZIL

Gerson Rissin PY1APS
PO Box 12178 Copacabana
20000 Rio de Janeiro, RJ
Brazil

NEW PRESIDENT OF LABRE

For about two years, Valmir Jacinto Pereira PT2FA was the president of the Brazilian Amateur Radio League (LABRE). During the time he commanded the League, Valmir gave his best efforts to establish reciprocal agreements with the leagues of almost all foreign countries. Most of them accepted his offer, and a few agreements were signed. Due to his excellent administration, PT2FA received from the Brazilian government the Merit of the Communications Medal.

On September 25, a new president was elected. Francisco Jose de Queiroz PT2FR will take care of our League and we hope that he can do a good job for us. Jose George da Rocha PT2GN is the vice-president, and the staff members are Pedro de S. Maciel PT2GAT, Paulo C. P. F. Pedroza PT2PPP, Jose Bonifacio F. dos Santos PT2YI, Ricardo Silva PT2RS, Pedro F. Filho PT2FF, Jose R. Medeiros PT2UN, Hugo A. da Silva PY2DSQ, Iran M. Jr. PT2ACZ, and Hardy Jost PT2NM.

SILENT KEY

A few months ago I wrote that November 6, 1984, would be a special day for Brazilian amateurs. That day was supposed to be celebrated as the centennial of Sebastiao Mattos PY1SM, a very active amateur in spite of his ninety-nine years. But God called Mattos less than one month before his birthday. He passed away three days after a heart attack, and his death represented a loss to all of us. Certainly he was the oldest active amateur in the world.

SPECIAL PREFIX

To celebrate the 50th anniversary of the University of Sao Paulo, a few PY2 stations were active during the second weekend of October, 1984, using the call ZY2AA. A special commemorative QSL will be sent confirming the OSO. The OSL information is PO Box 22, 01000 Sao Paulo, SP, Brazil.

WWSA—WORLDWIDE (CW) SOUTH AMERICA CONTEST

Sponsored by Grupo Editorial Antenna, from 1500 UTC June 8 until 1500 UTC June 9, 1985. CW only, from 10 to 80 meters. Work stations once per band. No cross-band QSOs. Exchange: signal report and serial number. Classes: single operator—single band or multiband; multi-operators—single transmitter and multi-band.

Count two points per OSO with a South American station. QSOs between South American stations count only for multiplier.

DXCC countries worked on each band count as multipliers for the South American stations.

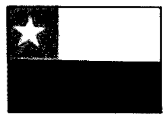
South American prefixes worked on each band count as multipliers for the rest of the world stations.

Multiply QSO points on all bands by number of multipliers on all bands.

Entries must be postmarked by July 31, 1985. Mail to WWSA Manager, PO Box 18003, 20772 Rio de Janeiro, RJ, Brazil.

ANTARCTICA

The Communications Department (DENTEL), considering the importance of the Third Antarctica Mission sponsored by the Brazilian Navy, issued a special prefix for the first Brazilian amateur-radio station in Antarctica: ZX0ECF. The equipment will be installed in the Oceanographic Station, which is called Estacao Oceanografica Comandante Ferraz, and the license is valid up to April 30, 1985.



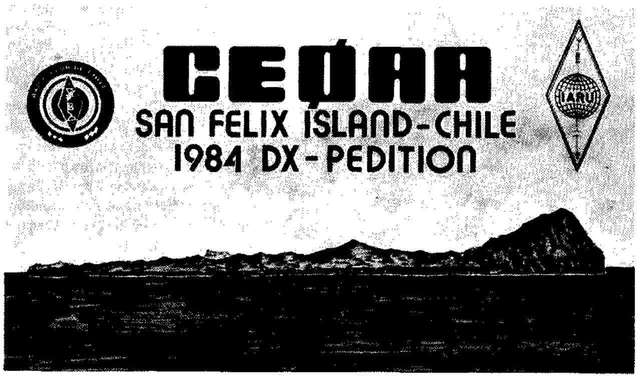
CHILE

Patricio Fernandez H. CE3GN
Ceramica Espejo S.A.
Calle Malpu 269
Casilla 14781

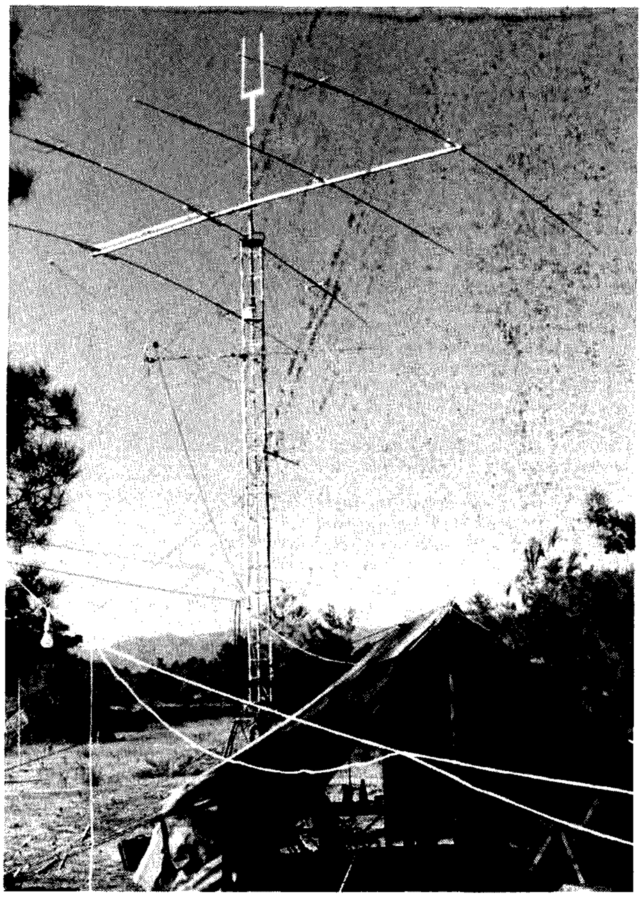
CE0AA SAN FELIX DXPEDITION

On the 21st of August, Rogelio Gomez CE3GF, president of Radio Club de Chile, gave me a phone call and told me: Patricio, this is it! The Navy has finally authorized the DXpedition. You have exactly ten days to organize everything and that includes the training of the operators who, although licensed hams from the Navy, have had very little experience in DXing and only spotty knowledge of the English language.

Under those circumstances, the task was formidable! We had too many negative factors: In addition to having very little time to train the operators and gather up all the necessary gear, we had to try to convince a number of directors and members from our radio club who did not wish to support or collaborate with a DXpedition of this nature. Radio Club de Chile had been in close contact with the Chilean Navy authorities (who are in charge of the island) for over 7 years, trying to get approval for the San Felix visit, and now that we had it, too many people thought



Left to right, standing, CE3GN, CE3ESS, CE9DVN; sitting, CE2GXY and CE3BBW.



Antennas and tent used for the Field Day by 5B4NC, the Nicosia Radio Club.

that the lack of experience of the operators might turn everything into a complete failure.

Nevertheless, having met the operators, Fernando CE2GXY and Max CE9DVN (both of them professional Navy radiomen and CW operators), I knew that we could do it, because above all they had big hearts, were most cooperative, and wanted to learn fast. In addition, they would be going to the island for a period of about 2 months, so I thought that if at first we used list operation procedures until they gathered up some experience, everything would end up fine.

In order to make a long story short, I will tell you only that during the week prior to the departure, the Radio Club de Chile headquarters resembled a beehive! I will never forget the great collaboration from friends such as German CE3CBG, Enrique CE3BBW, Mickey CE3ESS, Eduardo CE3BOC, Jorge CE3CTI, Marcelo CE3BXP, Celso CE3ACA, and others, who spent countless hours at the club helping, organizing, training Fernando and Max, and packing all the gear.

The equipment was furnished by both Radio Club de Chile and many of its members privately. In that respect, I would like to publicly thank Pablo CE3AJN, CE3ESS, CE3BBW, CE3CBG, Michel CE3DPD, and CE3BXP for having so generously lent their valuable transceivers, antennas, and accessories which were so vital to the DXpedition.

After arriving at the island on the 31st of August, both Max and Fernando worked practically all day and night until they had all of the equipment operating. By the way, the main gear consisted of one TS-600, two 830-S, one AT-230, a Honda E500 generator, a TET 4-element triband-er, and inverted vees for 160/80/40 meters. Everything performed flawlessly during the 2-month period which the DXpedition lasted.

On Saturday, September 1st, the first contacts were made with Santiago, and last-minute instructions were given for the official opening which would be the next day. And on that Sunday, after the first contacts were made, all hell broke loose as thousands of eager DXers tried to make a contact directly, without the help of the controllers. It took the controllers about one week to smooth things out and make most people understand that it would have to be list operation or nothing, at first, in order to make things easier for Fernando and Max. After all, San Felix had been included in the lists of the top 10 most-wanted countries for many years, so the demand was unbelievable.

After the first two weeks both operators had acquired much experience, and from then onward the DXpedition worked out very smoothly.

Those of you who heard the operation realize the magnificent job done by the net controllers. Many of them spent as much as 6 to 8 hours daily during the whole operation. My sincere thanks to CE3ESS, CE3BBW, Carlos CE3EEO, CE3DPD, CE3BOC, Ralf CE6EZ, Carlos CE3NR, and Mario CE6COR for a job well done.

Foreign net controllers played a vital role too, especially when propagation prevented local controllers from contacting the island due to skip conditions. In spite of the language barrier, it was incredible to hear how people like Toshi JA1ELY handled matters smartly and fast. Others like Eva PY2PE, Phineas W6BF, Ron KB7SO, Jack WB4GCP, Gail KF4IL, Jim KB7QC, John KCØYI, Loren K6EDV, Tex W6AHV, James NB7R, and Neil HKØHEU, to name a few, contributed immensely to the success of this operation, proving once more that international goodwill and understanding can do wonders.

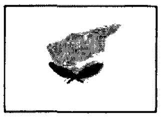
On October 4th I had to leave Santiago for a business trip outside the country, so Enrique CE3BBW was named general controller in charge of the operation. Before mid-October, Enrique wisely judged that the operators on the island had acquired enough experience and should be left alone, without assistance from the mainland. In that way, the DXpedition ended up with Fernando and Max working on their own and in such a way that nobody was able to criticize.

There is no official way, to my knowledge, to measure the success or failure of a DXpedition, but if number of contacts and bands and modes count for this evaluation, there is no doubt that this operation made a great number of DXers around the world very happy.

Here are some facts:

- Contacts: Over 32,000
- Bands: 160, 80, 40, 20, 15, 10, and 6 meters
- Modes: SSB, CW, and RTTY

During the first weeks of operation, criticism and misunderstandings were common on the bands. We even know of a few US DX bulletins which published disgusted opinions on the way the DXpedition was being handled. I trust that those who criticized at first will now understand. If not, we can't let it bother us because we know that over 32,000 hams all over the world now have a new one: San Felix Island!



CYPRUS

Aris Kaponides 5B4JE
PO Box 1723
Limassol
Cyprus

During the 1984 IARU Region 1 HF SSB Field Day Contest, two stations from Cyprus took part, the Nicosia Radio Club 5B4NC and the Larnaca Club 5B4LC. From Nicosia was sent to me the following report:

The location of the Field Day Contest was the same as last year's, a place called Kambia, about 10 miles out of Nicosia on the top of a hill. This year it was decided to use a four-element fourbander by TET which was mounted on a 26-foot tower. Also, dipoles for 40m, 80m, and 160m were used. The installation of the antennas was done early in the morning by a group of young amateurs and the rest of the group arrived later in the afternoon with the rest of the gear, which included a generator, a transceiver, a portable refrigerator, the drinks, and all the necessary foodstuffs for the traditional barbecue.

The weather was fine during both days, and on Sunday some of the XYLs visited the place and had lunch with the group.

The main thing about this year's contest is that the number of people taking part has increased. This year the following members of the Nicosia club took part and helped in many ways: Marios 5B4NM

with his daughter Marianna 5B4MB, Spyros 5B4MF, Andreas 5B4LP, John 5B4MC, Marios 5B4OJ, Nicos 5B4IT, George 5B4NJ, Vlas 5B4OL, Phidias 5B4OK, Andreas 5B4OM, Aris 5B4GZ, Costas 5B4FR, and Markos 5B4EP.

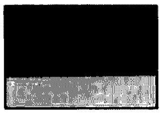
The main objectives of amateur radio are comradeship and the spirit of contests (which is not winning, but trying to win by being at one's best) and everybody had a nice time.

Other activities in Cyprus of the radio amateur fraternity included at the beginning of December the Annual Dinner Dance of CARS, which was in Nicosia this year and was a great success.

On the operation side, 5B4s can be heard mostly on 20m, although there is some activity also on the other bands. On 75m I was copying very well, long path, 1500 UTC, AA8AA, on the 30th and 31st of December and 2nd of January 1985. Unfortunately, due to my linear needing a new bandswitch and due to the QRM, the QSO was not completed.

On 2m there is some DX activity via meteor scatter by 5B4LP. There is some RTTY on 20m and 15m, and very soon, there will be some SSTV activity by 5B4CV, 5B4JE, and 5B4OV.

Members of the Nicosia Radio Club. From L to R, Nicos 5B4IT, Markos 5B4EP, Marios 5B4NM, Phidias 5B4OK, and Andreas 5B4OM.



FEDERAL REPUBLIC OF GERMANY

Ralf Beyer DJ3NW
Opferkamp 14
3300 Braunschweig
Federal Republic of Germany

SATURATION

Thinking of all the fancy and expensive communication equipment found in many amateur-radio shacks in this country, I consider German hams rather wealthy. Only a minority of them, however, are technology-oriented and still experimenting. The rest are more consumption-oriented, and with the present state of the art, the technological means for reliable and easy communication are within reach of the average German radio amateur today.

It is not surprising, therefore, that the enthusiasm for establishing contact even with a faraway station dwindles. Can you imagine, for example, the excitement of a radio amateur in Botswana using a 20-Watt CW transmitter and a dipole who gets a response from Germany? How would you rate, in contrast, the feelings of one of us who contacted Maximo CE0AA the fifth time on the same band in the same mode and gave him that boring 59 report although he was 3 by 4? Saturation makes the difference!

Saturation has many facets and aspects. Who is not fed up with the lousy modulation of the majority of stations in that particular part of the world which is the origin of numerous threats to amateur radio? It is evident that the trouble is not primarily a technical matter but a consequence of operator mentality (*"I'm working from a club station and I'm not in charge of maintaining the equipment"*). So we simply ignore these stations and try to live with their contribution to the pollution of the bands rather than giving them any advice on possible improvements.

A look at the content—the wording—of many QSOs reveals a comparable attitude. Hello, signal report, QTH, name, rig, 73, and good-bye is the recurrent format of the majority of them—a perfect case for automation. Of course, linguistic problems, pressure of time, and some other limitations demand this format sometimes. But it seems to be much easier to run through the same procedure even under the most comfortable operating conditions than it is to exhibit some mental flexibility, because it requires minimum effort and still gives the conviction that one is part of the game called amateur radio. Saturation again!

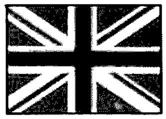
On the other hand, real gratitude is expressed most of the time if the correspondent at the other end of the line tries to convert the monotonous exchange of statements into a smooth flow of conversation, shuffling arguments and ideas back and forth.

Saturation has already become an issue in advertisements like the "Public Notice" of Bencher, Inc., published quite recently. In this particular advertisement they are emphasizing the thrills and satisfactions one can expect from personal achievements like the mental en-/decoding of telegraphy signals. I think, besides the commercial purpose of this advertisement, they have raised a crucial point of amateur radio: The more technical means for reliable and comfortable communication become available to everyone, the more difficult are personal achievements utilizing the more or less uniform communication equipment of the future.

But opposition against better-than-average personal achievements and higher qualification of one's neighbor is already with us. High-speed telegraphy at more than 40 wpm or so with mental en-/decoding is one of its targets. Deliberate interference to high-speed telegraphy QSOs and continuous requests for QRS without self-identification are unambiguous signs. Interruptions of foreign conversations ("Speak English or we QRM your frequency") can be heard from time to time on the frequencies of national DX nets and are another sign.

Much has been said about the future of amateur radio. A relatively small group of technology-oriented hams will advance the means of communication further and further. But the majority of radio amateurs should develop other powerful resources for a more interesting and more human utilization of the technical means. Awards and contests fulfill their purpose in creating pseudo-activities on the bands to defend the existing frequency allocations and to prove that there is a need for band extensions. However, they are not considered useful in the context of a more fruitful utilization of technical means.

More natural conversations, more interest in the fellow amateur's success or misfortune, demonstrations of courage of one's own conviction, abstention from complimentary signal reports, acquisition of some knowledge of foreign languages, spending a bit of our valuable time to give a hand to fellow amateurs, and many other such changes will help us much better to overcome the effects of saturation and to maintain and to strengthen amateur radio in the long run.



GREAT BRITAIN

Jeff Maynard G4EJA
10 Churchfields
Widnes WA8 9RP
Cheshire
England

THE UK SCENE

You may have noticed that after nearly two years of monthly contributions to *73* I have been relegated to a bimonthly contribution. This is not, I hasten to point out, an adverse reaction by *73* editorial staff but reflects the tremendous interest that "73 International" has generated. So many correspondents are now sending regular reports that there is insufficient room for yours truly every month. I may, therefore, report some items in a briefer-than-previous manner in order fully to cover the UK scene.

Fifty MHz comes closer to full availability for UK amateurs with the recent addition of 60 special licenses for this band. This brings to 100 the total number of 50-MHz operators currently operating in the UK. You will recall that with the imminent demise of television broadcasting in the 49-MHz band, the Department of Trade and Industry (the UK regulatory body) was persuaded to allow 50-MHz amateur operation outside broadcasting hours. Already there are many reports of good 50-MHz DX from the UK and 50/28 crossband contacts within the UK.

I have referred previously to the change in the UK telephone scene following the liberalization of British Telecom. An interesting variant of this theme comes recently from a piece of newly-liberalized hardware (you will remember that we now have a huge range of legal telephones to be bought in High Street shops). A British-Telecom-supplied Ambassador-type telephone (widely available for about $60.00) was found to be radiating within the 2-meter amateur band. It was actually putting out signals in three different parts of our 144-MHz allocation and in one further, non-amateur, band. The strength of the illegal radiation was sufficient to block channel S20 two blocks away. Since S20 is the FM simplex calling channel, it was not too long before a complaint was filed!

An indication of the popularity of amateur radio in the UK is given by plans for the 1985 Radio Amateur Examinations. The RAE, as the examination is known, is a prerequisite for a license of any type (except reciprocal). RAE centers are established only twice a year, in May and December. This year there are over 400 examination centers.

I wonder if you have yet heard the special-event callsign GB4DIS/MM? If you have, you can count yourself very lucky. The station is aboard the Royal Research Ship *Discovery* en route from Gibraltar to Montevideo (Brazil) via Port Stanley (Falkland Islands) and Ponte Arenas in Chile. Additionally, *RRS Discovery* hopes to call at South Georgia and establish a land-based amateur station. Operation on SSB and CW is promised with a possibility of RTTY as well. Spot frequencies are given as 14.023 and 14.123 MHz.

I still get a great deal of mail from *73* readers. I enjoy reading it—some even refers to amateur radio! I do, of course, reply to every letter received, but correspondents should be patient. Although my home address is still as listed above, I now work in London and am not home too often. When I do get back I like to spend some time with the family as well as play some golf. I am also finding myself in the USA frequently, and just as soon as I get myself organized, I will reapply for my US license and bring a rig with me. New York residents particularly should listen for G4EJA/W1.

ISRAEL

Ron Gang 4Z4MK
Kibbutz Urim
Negev Mobile Post Office 85530
Israel

The lowest spot on the face of the Earth is the Dead Sea, 394 meters (¼ mile) below sea level. From the north, the Jordan River drains into it, and from all other sides it receives the winter runoff from the wadis (dry river beds) of the surrounding desert. It's 78 kilometers (48 miles) long and 18 kilometers (11 miles) at its widest spot. Due to the great evaporation and continual inflow of water, its salt content is 25 percent of its water by volume, which is exploited by Israel and Jordan, on the western and eastern shores respectively, for the chemical wealth which it contains.

Not far from the salt mine at S'dom (thought to be the site of the Biblical Sodom of ill repute) stands a pillar of salt with a resemblance to the human form which tourists are told is the remains of the wife of Lot who, according to the Bible, when fleeing the city of Sodom which the Lord was destroying for its great wickedness, turned back for a last look and was transformed into a pillar of salt.

Indeed, during the summer months, the daily temperatures here are in the mid-40s Celsius (over 100 degrees Farenheit), and the area is quite inhospitable. Due to the high salt content of the Dead Sea water, no living organisms can survive in it and thus it is quite dead! Nonetheless, with the area's therapeutic hot sulphur springs, the oasis of Ein Gedi and the historic fortress of Masada (see my col-

umn, 73, April, 1984), the Dead Sea area is quite an attraction to visitors.

From the sixth through the thirteenth of April, in cooperation with the Israel Amateur Radio Club, the Holon Bat-Yam club will be operating from this lowest spot in the world. A special callsign, 4X5DS (note the special prefix), has been allocated and a triband beam has been flown in from a donor in Germany.

Operation on all bands from 80 meters through 10 is planned on SSB, CW, RTTY, and possibly SSTV. A commemorative QSL has been printed and will be sent to all stations contacting 4X5DS. As well, a special certificate will be awarded to amateurs contacting the station on either three different bands, modes, or days.

No doubt, it will be real challenge for many to contact 4X5DS as the location, at the bottom of the Great Rift Valley, caused by a geological fault running from Syria to Eastern Africa, is fenced in by mountains on the east and west. Coupled with the poor conditions characteristic of this point in the sunspot cycle, it will be quite an achievement for faraway stations to make contact.

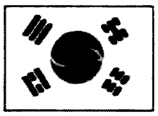
NEWS FROM AMSAT ISRAEL

The Israeli chapter of AMSAT has been officially formed and meets on Sunday evenings once every two weeks at the Tel Aviv University, in the same building that houses 4X8TU, the beacon that appears on the International Beacon Frequency of 14.100 MHz once every ten minutes. The aims of the chapter are to propagate information about the use of amateur satellites, to establish a club station for the use of its members to work through the birds, and hopefully to take part in the construction of a portion of a future satellite.

Although at the present time only seven or eight stations in Israel have OSCAR capability, interest is running high and thirty hams attended the last meeting.

The current meetings have taken on an educational air, with Yair 4X4GI giving fascinating lectures in a fashion that the layman can easily understand. In the last meeting, he outlined the history of the satellites starting from the first Sputnik, which he monitored on 20 MHz in 1958, and recalled the article which Arthur C. Clarke published in *Wireless World* in 1945, proposing then three geostationary satellites making worldwide communications possible, giving scientific proof that the idea was feasible. Yair pointed out that OSCAR I, the first satellite of the amateur-radio community, with its famous beacon transmitting HI in Morse, appeared only three short years after the Sputnik.

Yair then went into the physics and mathematics, showing what the parameters are of different kinds of orbits, what constitutes a geostationary orbit, a highly elliptical orbit such as that of OSCAR 10, the explanation of terms like inclination, subsatellite contact point, Kepler's Law of Equal Areas, etc. All of us present were indeed held spellbound!



KOREA

J. Michael Wengert KH2AC/HL
c/o ABC News
CPO Box 2961
Seoul
Korea

As it has been some time since the last column from Korea, here are some of the ham-radio club activities in Korea.

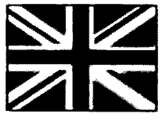
AARCK (American Amateur Radio Club—Korea) This group, made of of US Forces military and civilian personnel stationed in Korea, meets on the second Saturday of each month and provides a well-equipped club station (HL9TX) for the convenience of US soldiers who are unable to set up their own stations due to space limitations or who are here for a short period of time. Membership is open to anyone. Club president Craig Nicholson HL9NC operates as net control for the Far East Net on Sundays (0100 UTC—14.285 MHz) and airs the *Westlink* tapes (0130) for the benefit of hams all over the Far East and Southeast Asia. AARCK also operates the QSL Bureau for HL9 hams. Address for club and for QSLs to HL9 hams only: American Amateur Radio Club—Korea, Dependent Mail Section, APO San Francisco 98301.

SIARA (Seoul International Amateur Radio Association) This rapidly-growing group was organized for the following two purposes: to promote friendship between Korean hams and hams from other countries who reside in the Seoul area through regular meetings, nets, and social activities, and to promote reciprocal licensing agreements between the Republic of Korea and other countries.

While success in the second purpose seems to be some time in coming, the first purpose is rapidly being realized. A net began at 0700 UTC on 21.288 (88 for the '88 Olympics to be held in Seoul) on Saturday, January 12, 1985. Check-ins are welcomed from anywhere. Net control is Tom Nickle (W3GNM) operating his local station HL9XX. If you are interested in contacting this group, you may write to me at the address at the head of this column. If you live in the Seoul area and would like to call, the number is 734-8111 during working hours. This is an international group and anyone of any nationality with a license or interest in amateur radio is welcome.

In 1984, *KARL (Korean Amateur Radio League)* got a new slate of officers and has expanded greatly. My next column will feature this progressive and active organization.

Till then, 73 from Korea, the Land of the Morning Calm.



MONTSERRAT

Errol "Bobbie" Martin VP2MO
PO Box 113
Plymouth
Montserrat
British West Indies

LIVE FROM MARS

Well, once again it's brand new year, and for some of us it's new in more ways than for others, in the world of amateur radio.

In retrospect, 1984 was a very interesting year indeed. With Mother Nature doing the usual magic that only she is capable of, some of us were given the chance to defy her by working that new DX country to add to our Totem Pole, while others were provided another excuse for not being able to hear, let alone work, that elusive new one.

Here on the island of Montserrat, the Montserrat Amateur Radio Society (MARS) was continuing its usual activities: the daily disaster preparedness exercises via our local 2-meter repeater on the frequency 146.37/.97, also the regular exposure to the public by way of demonstrations and displays, along with scheduled amateur-radio training classes for persons interested in becoming amateur-radio operators, with special emphasis placed on the youths today, who will be the adults of the future.

This year started out very well for the operators of Montserrat in spite of the declined state of the sunspot cycle, for many have gotten out those rolled-up, forgotten pieces of copper wire and have been active on the low bands, which have been very responsive at nights, and I have worked many new ones.

For two young students of the Montserrat Amateur Radio Society, 1985 marked the birth of a new experience, for after a long series of studies, these two youngest hams took their exams, successfully passed, and were issued their licenses. These youths are Eddie Weekes VP2MIW and Franklin Rogers VP2MFG. They are now looking forward to obtaining their equipment and getting on the air as soon as possible. By the laws of Montserrat, no one is allowed to possess amateur-radio equipment unless he has obtained a license first. Here's wishing both Eddie and Franklin a very hearty welcome to the world of amateur radio.

LICENSING

Unlike many administrative licensing systems where the requirements are solely based upon the knowledge of Morse code (CW) and electronic theory, the qualifications for becoming an operator are not based on the above-mentioned standards only. In fact, Montserrat, being a 39-1/2-square-mile British Colony, has only two classes of licenses, A and B, but because of the fact that each resident considers himself to be an ambassador of his country on an international level (some might not realize this), no resident Montserratian would even consider taking the lower, thus restricted, class of exams. One studies for the more demanding level, and even if one fails on the first attempt, one usually brushes off the dust and tries again until met with success.

The licensing requirements on the Island of Montserrat are as follows: (1) To be able to copy and send Morse code at a speed of 12 words per minute. (2) To possess a clear knowledge of the fundamentals of electronic circuit theory relative to amateur radio. No big thing, you might say, but wait, that's not all; the real clincher comes next: (3) One has to possess the qualities of an "upstanding" character.

Therein lies the difference from other systems. Even though one can send CW at 100 wpm along with being an electronic engineer, those are definitely not enough reasons to permit one on an international medium such as worldwide communications, for, as stated above, each amateur-radio operator is an ambassador of his/her country, and amateur radio exists to promote peace and goodwill among men and women. One's operating, whether good or evil, is directly reflected back on his/her country, and who wants to disseminate garbage only to have it returned in one's face? Have you ever noticed the mannerism of resident VP2M operators? It is not surprising, for our country is a very small one of which we are all very proud, so we will never do anything to tarnish the fine image of this little emerald isle.

Let me point out once again that the Island of Montserrat has reciprocal licensing agreements with many countries, and following is a list of the requirements. Please write a letter of application to the licensing officer, Mr. Joseph Skerritt, Ministry of Communications and Works, General Turning Road, Plymouth, Montserrat, British West Indies.

Enclose (a) a copy of the license of the country of nationality (or in the case of being a resident of or citizen of another country, documents must be provided to substantiate that claim), (b) a recent photograph of the applicant (this is a recently added requirement), (c) an international money order in the amount of approximately $7.00 (US funds) made payable to The Accountant General, (d) estimated time of intended arrival and proposed length of stay on the island, and (e) intended address while here.

This information should arrive here at least two (2) months prior to the intended visit to allow time for the processing and the unpredictable mailing service.

CUSTOMS REQUIREMENTS AND DUTIES

Amateur-radio equipment is not duty free on this island *except* in the exclusive case of the Montserrat Amateur Radio Society and it's members, who have acquired this by the continued services being rendered on a daily basis, so visitors to the island pay a deposit which is returned upon exit at the port of entry. *Please note* that one should notify the Customs Department at least one day before departure and if it is towards a weekend, make this the last working day at least—Friday.

QSL INFORMATION

The Montserrat Amateur Radio Society meets on the first Wednesday of each month and welcomes any visiting ham to any of its meetings. One can always keep in touch via our local repeater, which is accessible from all parts of the island. Upon arrival, please get in touch with our Secretary/Treasurer, Ursula Sadler (Mrs.) VP2MDY either on two meters or via the land line which is listed in our local telephone directory, so that arrangements can be made for forwarding of those inevitable QSL cards that always seem to follow an operation here.

IRCs and Return Postage

Given the fact that we do not operate a QSL bureau here on the island, and that someone will always say he didn't hear the Manager's name being given, the question comes up about return postage, or more to my concern, IRCs (International Reply Coupons). This is the most misunderstood area of QSLing, and for this reason I state the following, with special concern regarding the US relative to the Caribbean.

One IRC costs US$0.65, which is equivalent to $1.78 ECC (Eastern Caribbean Currency), but nevertheless, IRCs are almost worthless here! Two IRCs are valued at about 80¢ ECC and are quite insufficient to mail a letter (single unit) to the US, the postage being $1.15 ECC. Even though in raw currency US$1.00 is equivalent to $2.71 ECC (which is fixed to the US dollar), IRCs do not necessarily reflect monetary exchange rates.

Of course I can't encourage you to send money in the mails, but on the other hand, in the Western world, who isn't doing it? Please absorb some of the strain of the Caribbean hams by sending them the proper amount of postage. Just for the record, it works both ways, for I always send at least two IRCs to the US Manager for QSL returns when it requires only one.

I hope to be able to provide you readers with further updates and thoughts on the subject of amateur radio from a Caribbean view, so please keep on looking at these pages for much more in the future. In the mean time, also between time, do have a very healthy 1985 and gud DX to you all. Keep the faith and the hobby going, better times are always ahead. Stay tuned to this frequency as we are Very Pleased To Make Oscillations (V-P-2-M-O).

DEALER DIRECTORY

PROPAGATION

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA	20	20						15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40	40		20	15	15	15	15	
SOUTH AFRICA									15	15	15	
U. S. S. R.							20	20				
WEST COAST			80	80	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
SOUTH AFRICA										15	15	20
U. S. S. R.								20	20			

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20	20				15
PHILIPPINES	15							40		20		
PUERTO RICO			20	20	20	20	20	20				15
SOUTH AFRICA										15	15	
U. S. S. R.									20			
EAST COAST		80	80	40	40	40	40	20	20	20		

A = Next higher frequency may also be useful.
B = Difficult circuit this period.

G = Good, F = Fair, P = Poor.

APRIL 1985

SUN	MON	TUE	WED	THU	FRI	SAT
	1 G	2 G	3 F	4 F-P	5 P	6 P-F
7 G	8 G	9 G	10 F	11 G	12 G	13 G
14 G-F	15 F-P	16 P	17 F-P	18 G	19 G	20 G
21 G	22 G-F	23 P	24 P-F	25 P-F	26 F	27 G
28 G	29 F-G	30 G				

Issue #296

OUR 25th ANNIVERSARY YEAR!

$2.50 USA May 1985
$3.00 Canada

73 for Radio Amateurs

® A CWC/P Publication

International Edition

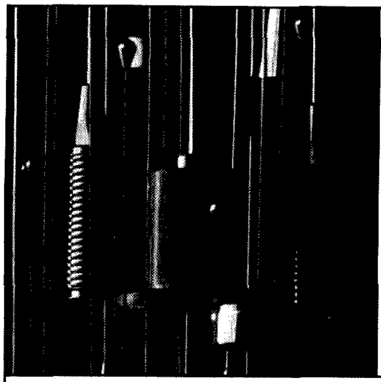
SPECIAL ANTENNA ISSUE!

- Super Skywires
- Tutorials and Tuners
- News and Reviews

Tales From the Antlers Inn

IMPROVE YOUR QSO SKILLS

0 74470 65946 05



73 for Radio Amateurs®

ISSUE #296 MAY 1985

On the Cover:
Antenna Extravaganza!
Photo courtesy of MacGibbon & Kobasic, Portland OR, as part of an advertising campaign for Larsen Electronics.

4 **Never Say Die**
6 **What?**
7 **QRX**
58 **Barter 'N' Buy**
59 **Special Events**
62 **Satellites**
63 **RTTY Loop**
64 **DX**
65 **Letters**
66 **Contests**
67 **Be My Guest**
68 **Review**
70 **Fun!**
82 **New Products**
86 ***73* International**
90 **Ham Help**
92 **List of Advertisers**
94 **Dealer Directory**
94 **Propagation**

17 **Discover the Discone**
Is this the perfect aerial? Consider simple wire construction, easy one-time tuning, and flat swr from 3.5 to 28 MHz. W1GV/4

22 **Two for Two**
We respectfully offer a pair of radiators for the two-meter band so elegant, yet so simple, that you will kick yourself for not thinking of them first. WA4BLC

24 **The Snake with LED Eyes**
A tall tale from the Antlers—where the decoration is strange and the stories are even stranger. WA8WTE

32 **Up, Up, and Array**
W6TYH's hybrid collinear will rocket your signal to new heights! W6TYH

38 **Good to the Last Dot**
Is there life beyond WX HR IS? With these practical tips you'll perk up every QSO and make every contact an adventure! N6HYK

40 **Porcupine Mobile**
Bristling to work HF from your car? Sport these spikes and hit the road. N2CMU

42 **The Rubber Duck Debunked**
In ten minutes you can have 10 dB gain over your HT's duckie. It's enough to make you try. W4NVK

44 **The No-Baloney Lunchbox**
We suggest you paint this antenna tuner before showing it to your friends. KR3T

48 **Rotate the Bobtail Curtain**
How do you rotate one hundred feet of wire antenna? It's simple: Just flip the switch. W8HXR

50 **Alligatored Antennas**
(clip) It's 30m...(clip) it's 17m...(clip) it's 12m. Get the idea? .... WØMBP

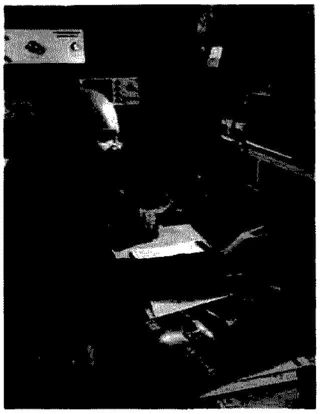
52 **Zuper Zepp for VHF**
Zip up your zignai with UZM's planz! WA4UZM

54 **Phase the Nation**
North, south, east, or west, you'll be on target with the double-X trapped-vertical array. KB2XX

56 **Where Am I Pointed?**
Is this Sinclair beam-aimer program just like every other? Guess again. AD1B

Editorial Offices: Pine Street, Peterborough NH 03458, phone: 603-924-9471. **Advertising Offices:** Elm Street, Peterborough NH 03458, phone: 603-924-7138 **Circulation Offices:** Elm Street, Peterborough NH 03458, phone: 603-924-9471. **Manuscripts:** Contributions in the form of manuscripts with drawings and/or photographs are welcome and will be considered for possible publication. We can assume no responsibility for loss or damage to any material. Please enclose a stamped, self-addressed envelope with each submission. Payment for the use of any unsolicited material will be made upon acceptance. All contributions should be directed to the *73* editorial offices. "How to Write for *73*" guidelines are available upon request. US citizens must include their social security number with submitted manuscripts. **Subscription Information:** Rates: in the United States and Possessions: One Year (12 issues) $24.97; Two Years (24 issues) $38.00; Three Years 36 issues) $53.00. Elsewhere: Canada and Mexico—$27.97/1 year only, U.S. funds. Foreign surface mail—$44.97/1 year only, U.S. funds drawn on U.S. bank. Foreign air mail—please inquire. To subscribe, renew or change an address: Write to Subscription Department, PO Box 931, Farmingdale NY 11737. Send Canadian changes of address to: 73, PO Box 1051, Fort Erie, Ontario CANADA L2A 5N8. Return postage guaranteed. For renewals and changes of address, include the address label from your most recent issue of *73*. For gift subscriptions, include your name and address as well as those of gift recipients. For questions concerning your subscription and to place subscription orders, please call us toll free at 1-800-645-9559 between 9 am and 5 pm or write to *73*, Subscription Department, PO Box 931, Farmingdale NY 11737. *73 for Radio Amateurs* (ISSN 0745-080X) is published monthly by CW Communications/Peterborough, Inc., 80 Pine Street, Peterborough NH 03458. Second class postage paid at Peterborough NH 03458 and at additional mailing offices. Canadian second class mail registration number 9566. Microfilm Edition—University Microfilm, Ann Arbor MI 48106 Postmaster: Send address changes to *73*, Subscription Services, PO Box 931, Farmingdale NY 11737. Nationally distributed by International Circulation Distributors.

W2NSD/1



NEVER SAY DIE

editorial by Wayne Green

ANTENNAS

Articles on antennas have always been a ham favorite—and for a good reason. It's been a couple of generations since our ham transmitters and receivers were simple enough for the average ham to build, but anyone can still design and build an antenna.

Even when I first got started with amateur radio, 45 years ago, few hams were building their own receivers. I used to go all over Brooklyn visiting the hams I heard on the air, and only one had a homemade receiver. Oh, I built one—a reader sent me one of my SWL cards listing it recently—but as soon as I had the money, I bought a Hallicrafters SX-20—the Sky Champion.

Since there were far too few hams to support a manufacturer before the war, it wasn't until after WWII that the first relatively low cost commercially-made ham rigs began to appear. Once rigs could be bought, few hams bothered to build 'em again. Oh, that didn't stop hams from building gadgets, RTTY terminals, and so on, just transmitters and receivers.

Many of the experimenters headed for the VHFs, but Gonset and Heath pretty much put an end to that with commercially-made VHF rigs.

Through all of this the ham love affair with antennas has continued. Oh, not many hams understand the antenna engineering, but that doesn't stop most of us from whipping out a back issue and a soldering iron and putting something together to test. We're all in search of the ideal antenna.

I've a little secret—I've hit the antenna jackpot a couple of times down through the years. I remember when I was at college after the war. I'd taken over the basement of the fraternity house with my two kilowatt rigs, my SX-28A, and a National receiver. *CQ* had published an article on a Twin-Three antenna (also called a Twin-Triplex), so I plunged out into the yard and put four of them together in the snow—two for twenty meters and two for ten. We had about four feet of snow in the yard, so every time I put down my soldering iron it would melt out of sight.

The Twin-Three was a wire beam with two three-wire dipoles spaced a sixth wave apart. Both dipoles were fed with twinlead. This meant I had to run 30-foot-long wires between two ten-foot-long 2" × 2" boards, put an insulator in the center, solder the wires together at their ends, and hang the whole works between a tree and the fraternity house. It took two antennas for each band because there wasn't any way to rotate them and each was bi-directional.

I finally got the whole works put together and up in the air. I hooked them to relays to switch directions and bands. They worked beyond all my dreams. The Twin-Three antenna has a very narrow vertical angle of radiation and a wide horizontal angle, so I was able to reach most of the world just by switching antennas.

The narrow vertical angle meant that my signal would be very powerful at one spot and then move on. I had to learn to keep my contacts short. The angle was particularly low, so most DX stations would tell me that I was the only US station coming through. When most other ops were talking with England, I was working Germany. When their signals would start being heard in Germany, mine were fading out and Italy was calling.

I remember one morning

Continued on page 63

QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, 80 Pine Street, Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

STAFF

EDITOR
Wayne Green W2NSD/1

EXECUTIVE EDITOR
Susan Philbrick
MANAGING EDITOR
Steve Jewett KA1MPM
TECHNICAL/INTERNATIONAL EDITOR
Perry Donham KW1O
EDITORIAL ASSISTANTS
Nancy Cook
Richard Phenix
Chris Schmidt KA1MPL
DESIGNERS
Diane Ritson
Linda Drew
ASSOCIATES
Robert Baker WB2GFE
John Edwards KI2U
Bill Gosney KE7C
Chod Harris VP2ML
Dr. Marc Leavey WA3AJR
Bill Pasternak WA6ITF
Peter Stark K2OAW

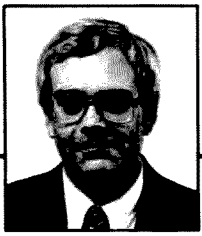
ADVERTISING
1-800-441-4403
SALES MANAGER
Jim Gray W1XU
ASSISTANT SALES MANAGER
Nancy Ciampa
SALES REPRESENTATIVE
Ross Kenyon KA1GAV

MARKETING MANAGER
Hope Currier

GRAPHIC SERVICES DIRECTOR
Christine Destrempes
MANUFACTURING MANAGER
Susan Gross
TYPESETTING MANAGER
Dennis Christensen
FILM PREP MANAGER
Robert M. Villeneuve
DARKROOM MANAGER
Nathaniel Haynes
GRAPHICS SERVICES SUPERVISOR
Dawn Matthews

VICE PRESIDENT/GENERAL MANAGER
Debra Wetherbee
VICE PRESIDENT/FINANCE
Roger Murphy
ASSISTANT GENERAL MANAGER
Matt Smith KA1IEI
ASSISTANT TO VP/FINANCE
Dominique Smith
DIRECTOR OF CIRCULATION
William P. Howard
CIRCULATION MANAGER
Frank Smith
DIRECT AND NEWSSTAND SALES MANAGER
Raino Wirein
1-800-343-0728
DIRECTOR OF CREDIT SALES AND COLLECTIONS
William M. Boyer

PUBLISHER
John C. Burnett



WHAT?

News from the Publisher

This will be bad, sad news for doters on doom and gloom for amateur radio. We do need to grow—there's no question about that. There's a lot of work to be done—to think otherwise would be carrying naivete to its extreme. But is ham radio '85, right now, today, alive and well and stronger than most people think? YES. With a better future than most people predict? YES, YES, YES.

Am I guessing? No. What if YOU wanted to check out the real health of amateur radio in the United States today? What if you wanted to find out how hams really feel? Would you take a poll by mail? No. Would you call people up and talk with them—at times for almost an hour? YES. And that's what we did. And what we found out was not just interesting, but also very, very heartwarming.

Systematically at random (so that every call area would be proportionally represented), we selected 100 calls from the *Callbook*. We called information to get their phone numbers. Then, for almost two weeks, we tried to reach them. It took 188 calls before we were through. Here's part of what happened: Five numbers were tried five times each with no answer. We reached the families of three Silent Keys. Ten selectees were away or were just flat out unreachable (e.g., "In Australia, don't know where"). Six people reached preferred not to take part. So as it turned out, 76 people (not just *73* subscribers, I should emphasize) volunteered to share their thoughts about amateur radio.

The ground rules were simple: Tell the truth. We never volunteered the fact that *73* was calling. If asked, though, we immediately explained who we were. 67.4% of the people reached didn't even ask. Almost everyone was excited to have the opportunity to speak up on behalf of his hobby. 72.6% turned down the offer of a letter confirming the confidentiality of their conversations, and 92.1% definitely wanted to be part of a follow-up survey sometime later this year.

What did we talk about? Mainly about operating habits and buying plans, but also about magazines and microcomputers. As this is being written, the compilation of results stands at 26 pages and counting/mounting. During the coming months, we'll certainly be sharing with you this information about who '85's hams really are and how they really think. In the meantime, you might like to know that 46.1% of you belong to a local amateur-radio club or organization and that 89.5% of you could get on the air right now, this second. And amateur radio is a dying service?

I'd like to say thank you, in a very cryptic way, to the 76 people who were kind and caring enough to share their time with us. They're listed below, but since total confidentiality was assured, only the second-to-last letter of their last names and the second-to-last letter of their calls are shown. The footnotes are hints for duplicates—just so they know they weren't forgotten.

A/E	E/N	I/Y	O/B (14)	R/I
A/G	E/O	K/E	O/B (15)	R/M
A/K	E/Q	L/B	O/K	R/W (21)
A/N	E/R (6)	L/S	O/M	R/W (22)
A/O	E/R (7)	L/T	O/N	S/Q
C/R	E/S	L/W (10)	O/P (16)	S/U (23)
D/K	E/Y	L/W (11)	O/P (17)	S/U (24)
E/E (1)	F/D (8)	M/I	O/P (18)	T/D
E/E (2)	F/D (9)	M/O	O/R	T/E (25)
E/H	F/X	N/C (12)	O/S (19)	T/E (26)
E/J	G/T	N/C (13)	O/S (20)	T/F (27)
E/K (3)	I/E	N/N	O/W	T/F (28)
E/K (4)	I/H	N/T	P/G	T/G
E/K (5)	I/I	N/V	R/D	T/H
E/L	I/O	O/A	R/G	T/O

(1) Ford Driver	(15) ZIP Code totals 18
(2) Electronics Prof	(16) The Alamo
(3) Ella	(17) Held for Ransom
(4) ZIP Code totals 20	(18) For the East Trees
(5) Port of NY	(19) Prince?
(6) Club Notes Only	(20) ZIP Code totals 14
(7) Ups and Downs	(21) Rocky
(8) ZIP Code totals 11	(22) ZIP Code totals 20
(9) Port of FL	(23) WWV
(10) Up the Creek	(24) ZIP Code totals 24
(11) ZIP Code totals 24	(25) Halfway I
(12) ZIP Code totals 9	(26) A Dud
(13) Trail Drive	(27) Halfway II
(14) Cardinal Call	(28) IBM Loafer

Finally, two stories. One person I reached was the XYL of a Silent Key. "G" is one of the nicest people you would ever want to talk with and also one of the greatest supporters of amateur radio and the code. And the code. And the code. After we had spoken for quite a while, she mentioned that she had had a relative involved with code in the early days. I took a chance and asked her if she would mind telling me her maiden name. "Not at all," she said. "Morse."

And then, for those of you who counted our thank-you's, there is #76—the last person reached and the only way our survey was skewed. Standard methodology says that you try five times and then quit. But this was the last MIA after 13 days and nights of calls by Hope Currier and Chris Schmidt and Perry Donham and me, so I said heck, we'll give him a sixth shot. Plus, he's a pickle trucker, which I thought might qualify him for some sort of a break. I left a message with his daughter: If he's interested, have him call me collect at home between 6:00 and 8:00 EST on Sunday. The time came and went, and the survey was at last finished. And then, at 10:05, the call came, "I'm sorry I couldn't get back to you sooner. I've been on the road all week. I'd be glad to take part in the survey, but I hope you understand that I'm just a Novice. Is that alright?" Be still, my heart.

Jack Burnett

73 for Radio Amateurs is a member of the CW Communications/Inc. group, the world's largest publisher of computer-related information. The group publishes 52 computer publications in 24 major countries. Nine million people read one or more of the group's publications each month. Members of the group include: Argentina's *Computerworld/Argentina*; Asia's *The Asian Computerworld*; Australia's *Computerworld Australia, Australian Micro Computerworld, Australian PC World* and *Directories*; Brazil's *DataNews* and *Micro-Mundo*; China's *China Computerworld*; Denmark's *Computerworld/Danmark* and *Micro Verden*; Finland's *Mikro*; France's *Le Monde Informatique, Golden* (Apple) and *OPC* (IBM); Germany's *Computerwoche, Microcomputerwelt, PC Welt, Software Markt, CW Edition/Seminar, Computer Business* and *Commodore Magazine*; Italy's *Computerworld Italia*; Japan's *Computerworld Japan* and *Perso ComWorld*; Mexico's *Computerworld/Mexico* and *CompuMundo*; Netherland's *CW Benelux* and *Micro/Info*; Norway's *Computerworld Norge* and *MikroData*; Saudi Arabia's *Saudi Computerworld*; Spain's *Computerworld/Espana* and *MicroSistemas*; Sweden's *ComputerSweden, MikroDatorn, Min Hemdator* and *Svenska PC World*; the UK's *Computer Management, Computer News and Computer Business Europe*; the US's *Computerworld, HOT CoCo, inCider, Infoworld, MacWorld, Micro Marketworld, PC World, RUN, 73* and *80 Micro*.

QRX. . .

EDITED BY PERRY DONHAM KW1O

Say Again?

HAVE YOU EVER transmitted with excessive power? You know, that time the rare DX was on and "just a few more Watts" helped you break the pileup. Of course, we all have heard of the California Kilowatt, but now a new definition has arisen—the "Texas Triplewatt!" Jerry Dyke WB5LEU was caught driving a Drake linear with his Collins S-line. The *linear* was driving a 3CX10000T with a rating of about *48,000 Watts!* Jerry was running a "conservative" 25 kW in the Novice band, allegedly in retaliation for harassment by other hams on 3895 kHz. Jerry, whose station had been monitored by the FCC's Houston Field Office, was fined $2000 for the infraction.

73 On Line

THE *73* BULLETIN BOARD is now on line! Currently running on a Leading Edge microcomputer, the BBS supports 300 or 1200 baud and offers text files and software to download, a place to upload your own files, current bulletins, news from the world of ham radio, and a personal mail system. You can upload letters to the staff, "Ham Help" requests, or even articles for us to review! Try it out—the BBS is on from 2200 to 1200 UTC weeknights, and all day Saturday and Sunday. The number is (603)-924-9809.

Pirates

SPEAKING OF BULLETIN BOARDS, the **Association of Clandestine Radio Enthusiasts** has set one up with information about unofficial and pirate radio stations and extracts from ACE's monthly magazine. A personal mail system is also offered. The BBS, which supports 300 or 1200 baud, may be reached 24 hours a day at (913)-677-1288.

Sky High

THE NEXT HAM-IN-SPACE FLIGHT is scheduled for later this year. Astronaut **Tony England W0ORE** will be aboard the 51F mission of the orbiter *Challenger*, carrying as much amateur gear as he can. Tony says that groups or individuals wishing to work him during the flight should contact the ARRL, as it is acting as a clearing-house for the requests. Tony will concentrate on keeping schedules with school classrooms and radio clubs. The original ham in space, Owen Garriott **W5LFL**, will be back in space on a mission coming up next year.

Mr. Ed

NEW YORK MAYOR Ed Koch was exposed recently to amateur radio by a group of students from Junior **High School 22** on Manhattan's Lower East Side. The youngsters, who had just completed a period of English via Ham Radio, were calling CQ on their favorite frequency, 21.395 MHz. John WA9YHW/HR, off the coast of Honduras, answered the call. John is an old friend of the class, and asked for a favor. "Call up my friend Ed. . .and tell him his friend John from Westhampton Beach wishes him the best of luck. . ." Undaunted by the enormity of the task, the group rang up the Mayor's office. It took careful explanation of ham radio by the students, but the Mayor's secretary finally promised to deliver the message. A few days later, the class received a personal note from Mayor Koch thanking them for their relay and expressing an interest in observing their program.

Grab Bag

WE'RE GIVING AWAY the entire United States! Recently a box surfaced in the W2NSD shack that contained scads of giant **Worked All States Maps.** Well, maybe not *giant*, but certainly very large. All right, they're 17" × 11". That's *pretty* big. If you would like one of your very own (while they last), drop a big SASE in the mail to *73* Magazine, 80 Pine Street, Peterborough NH 03458, Attn: Giant Map. We've also got plenty of the wonderful 10-meter beacon lists. Save a stamp and ask for them both!

SWL Society

SHORTWAVE LISTENERS, hams, and other radio enthusiasts are invited to join the **Great Circle Shortwave Society.** The GCSS feels that the 1950s and 1960s were fascinating years in the world of shortwave, and publishes a newsletter devoted to the period. Special emphasis is placed on SWLs who were active during the period between the Korean War and the Vietnam War, and who hold *Popular Electronics* "WPE" shortwave-monitor callsigns. For a sample newsletter and information about GCSS, send an SASE to Richard Arland WPE7BYR, Secretary, Great Circle Shortwave Society, 2042C Flyer Drive, Bethel Manor, Langley AFB VA 23665.

The crew at JHS 22.

Thus Spake Drake

EVEN THOUGH R. L. DRAKE no longer makes amateur-radio equipment, that doesn't mean that they can't service your gear. According to **William Frost WD8DFP,** Service Manager for Drake, "While it is true that the company has curtailed its manufacture of amateur-radio products, it is not true that the company does not exist! The service department still provides service and overhaul on any R. L. Drake Company product ever made and will continue to do so until unique parts for [a] product are no longer available, or the cost of repair exceeds the value of the product." Drake is still at 540 Richard Street, Miamisburg OH 45342, and you can call Drake at (513)-866-3211.

Homebodies

CHRIS ANDERSON KA8RJY wrote in to alert everyone about his **National Homework Net (NHN).** Chris says, "I'm fourteen and am Net Manager for the NHN, which meets every Saturday night at 0100 UTC on 3.870 MHz. We need to be exposed to the outer world and would greatly appreciate a small tidbit that maybe would gather some more teen amateurs to our net." How about it, gang? Why not drop in on Chris and the NHN? Or you can write to Chris at 085 Walker Road, Jackson OH 45640. Tell him "QRX" sent you.

Well?

WHAT DO YOU THINK? I hope you've noticed the changes we've made in *73*. We try to be as flexible as possible to make this *your* magazine, but we need to know what *you* want to see. Would you like more construction articles? More humor? Articles on DX and operating? Or maybe you have an idea for a new column or feature. You may even like things just the way they are.

Let us know—jot down your thoughts on a card and drop it in the mail. The address is *73* Magazine, 80 Pine Street, Peterborough NH 03458. Remember, the name is *73 for Radio Amateurs*. . .that means *you*!

Ham Fam

CAN YOU TOP THIS? We recently received a letter from **Nellie Myers KA9DVY,** editor of *The Dam Paper*, journal of the Tri-County Amateur Radio Group, describing the Johnson family. On the surface, the Johnsons look like ordinary folk, but *all seven* of them are hams! In the photo are (front row) the Reverend Johnson WØKPS and his wife Doris KA9RTK, (back row, left to right) Nancy KA9TAR, Thomas KA9RRL, Greg KA9RRN, William WBØYNL, and Sheryl KA9RRM. Quite a group! I wonder if there's a waiting list to use the rig?

The Johnson family portrait.

XKGP7QTMP!

ALPHABET-SOUP SYNDROME continues to plague the amateur bands. If you are baffled by the strange prefixes you've been hearing, the following information should serve to confuse you even further. Corsica is now TK and French Antarctica is FT. Inside France, the first letter will still be F, but a second letter has been added to designate the license class in these categories: A—minimum age 13, no-code exam, 144 MHz only; B—minimum age 13, 144 MHz with a few CW segments on 10-40 meters and voice on 28.4 to 29.0 MHz; C—minimum age 16, no-code exam, 30 MHz and up; D—minimum age 16, all privileges; E—class-D hams with 3 years experience. In overseas departments and territories of France, the number in the callsign will change—1 becomes 3; 7 or 8 with less than 3 years in that class becomes 4; 5 indicates a license held for 3 years. Say what?

Prefix Fix

PREFIX HUNTERS will have a chance to work three special Canadian calls during the celebration of the 100th anniversary of the Canadian National Parks System. From June 29th to August 29th, you'll hear XO for VO, XJ for VE, and XK for VY.

Lifers

HOLDERS OF FCC COMMERCIAL TICKETS are now eligible for the new Lifetime Operator License. If you hold an FCC First Class, Second Class, or General Radiotelephone certificate, you automatically qualify. Send your request, including your name (as it appears on the license), your date of birth, and your license number, to the FCC Field Office that issued your ticket. Write "Lifetime License" on the envelope, and enclose an SASE. Enclose a *big* SASE if you don't want your certificate folded.

Packet Places

ARE YOU WONDERING if there is any packet-radio activity in your area? Here are a few frequencies (in MHz) that you can listen on to hear some of the action: Annapolis 10.147, Atlanta 146.13/.73, Baltimore 145.01, Chicago 144.95, Colorado Springs 147.50, Dallas 147.57, Denver 145.70, San Francisco 146.58, St. Louis 147.555, Washington DC 145.01, Eastnet 145.01, Pacific Northwest 146.55, and 145.36 in Southern California. Packet sounds like flies having a chat.

Foxy

IS CHASING FOXES your idea of a good time? If so, let us know. *73* is working on a super fox hunt that would begin with competition at the local level, then advance to a regional contest. The best team in each region would assemble for a national fox hunt to determine the best DF team in the country. We are looking for comments and suggestions on every aspect of the trial, including rules, frequencies, and standard equipment. Send your input to *73* Magazine, 80 Pine Street, Peterborough NH 03458, Attn: Fox Hunt.

Crash! Bang!

ELIMINATE RF COLLISIONS between terrestrial and space communications by avoiding our satellite passbands. AMSAT urges all amateurs to reserve 29.3-29.5, 145.8-146.0, and 435.0-435.5 MHz for amateur satellite work. Remember, satellites can't easily QSY—we can.

QSL?

HAVE YOU WORKED 4W1CW, YN1Z, YN1CW, H7Z, or TG9XGV? Here's a word from the manager. "USPS notified us this week that the address to which we sent all QSLs is now obsolete; the operator of those stations has moved and left no forwarding address. Possibly we can locate him at a different QTH, but for now we are holding all incoming QSLs for these callsigns." Can anybody help? The fellow's handle is Gun, and he works high-speed CW. Send your information to Bill Wellborn K4CLA, 562 Oak Drive, Lexington SC 29072.

Caveat

IF YOU'VE PURCHASED a Yaesu FT-757GX for what seemed a "bargain-basement" price, you may be in for a few headaches. In an interview appearing in the *W5YI Report*, **Bob McKay N8ADA** said, ". . .there are Yaesu 757GX radios being sold that are not the same as the 757 models being advertised nationally. The radios are identical in appearance but do not have the CW filter, will not work on the new WARC bands, and cannot be serviced in the USA." Bob is the editor of *The Carrier*, journal of the Dayton Amateur Radio Association. It looks as though someone has imported transceivers intended for sale only in Japan. The radios may have been illegally imported, but they could be legal since most amateur gear does not require type-acceptance by the FCC. The shipping crates have markings on them indicating that the rigs may only be serviced in Japan. Chip Margelli of Yaesu has indicated that service and repair can be done in the US, but the warranty is not valid here in the States. In any case you should be wary of a deal that seems to be too sweet.

Knock, Knock

A GOLDEN OPPORTUNITY awaits the right person! **Ham Radio Outlet** is looking for someone to manage a new amateur-radio store in the New England area. HRO is an established company in the ham-radio industry and offers a great employee-benefit package. The manager/trainee will spend time in California learning his or her job. If this sounds like something you would like to do, send your resume to Bob Ferrero at Ham Radio Outlet, 2620 West La Palma, Anaheim CA 92801.

Hot Pix

DO YOU HAVE A PHOTO that would look good on the cover of *73*? We're always in the mood for a great picture. Send your shots in for evaluation! The pictures should be vertical, like the cover, and should have a nice space in the upper left corner to tuck our logo. We prefer large-format transparencies, but we'll also consider high-quality 35-mm slides or color prints. Forward your photos to *73* Magazine, 80 Pine Street, Peterborough NH 03458. Enclose an SASE if you'd like your pictures returned.

Stan Gibilisco W1GV/4
PO Box 561652
Miami FL 33156

Discover the Discone

Is this the perfect aerial? Consider simple wire construction, easy one-time tuning, and flat swr from 3.5 to 28 MHz.

With the addition of the new WARC bands, *amateur radio* operators will have HF allocations at eight points over an eight-to-one frequency range. Multiband antennas will become quite complicated, except for broadband types, which will probably become more and more popular. Such antennas as the dipole with tuned feeders, the random wire, the log periodic, and others will be used by many hams in pursuit of multiband operation.

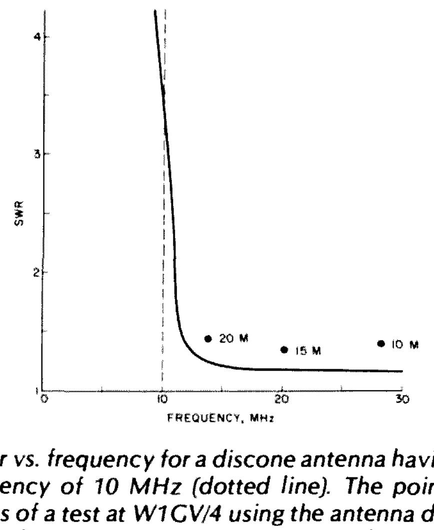


Fig. 1. Swr vs. frequency for a discone antenna having a cutoff frequency of 10 MHz (dotted line). The points show the results of a test at W1GV/4 using the antenna described in this article. Any swr less than 3 was considered tolerable.

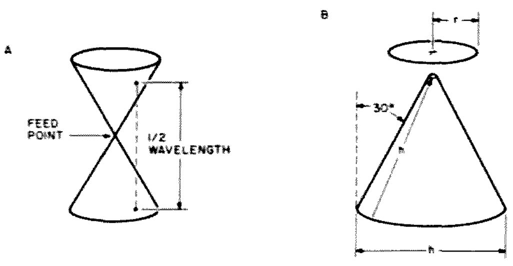


Fig. 2. Design of a bi-conical antenna (A) and a discone (B). The discone is a modified bi-conical antenna, in the same way an inverted ground-plane antenna is a modified vertical dipole.

This article describes the theory, design, and construction of a broadband vertical for the range 10 through 30 MHz. This antenna is an adaptation of a technique usually seen only at VHF: the discone. This antenna displays vertical polarization and excellent low-angle radiation; it needs no radial system, and it has a fairly flat, low swr curve over a continuous frequency range. A theoretical swr response is illustrated in Fig. 1.

Theory

The concept of the discone originated with the notion that if an antenna could be constructed whose dimensions were specified by angle measures only, then it would function independently of the wavelength. The bi-conical antenna (A in Fig. 2) is one such device. If the two cones extend sufficiently above and below the feedpoint, then resonance can exist at any frequency above f_{min}, where the altitudes of the cones are 1/4 wavelength. The electromagnetic field flows outward from the feedpoint along the surfaces of the two cones until it reaches points separated by 1/2 wavelength, as shown. Clearly, this will be possible at any frequency larger than f_{min}, provided the vertices of the cones come together precisely at the feedpoint.

As the frequency is moved below f_{min}, it is no longer possible to find two points on the cone surfaces separated by 1/2 wavelength in space. Consequently, the swr increases rapidly. When the frequency is lowered so that the slant height, h, of each cone is equal to 1/4 wavelength, we say that the bi-conical antenna is at f_c—its cutoff point. The swr at cutoff varies depending on the vertex angle of the cones. Below f_c, the swr rises with extreme steepness to prohibitively high values. Thus the bi-conical antenna represents an electrical high-pass filter with a lowest practical frequency of f_c.

A bi-conical antenna obviously presents structural problems at high frequencies although it is perfectly practical at VHF. To reduce the physical size of the antenna, the discone was de-

veloped. Either the top or bottom cone may be replaced with a reflecting radial system, and then the antenna will function over the same frequency range (provided the reflector is large enough). If we replace the lower cone with a radial system and bring the feedpoint to ground level, we have an antenna known as a conical monopole. By replacing the top cone with a reflecting disk of sufficient size (B in Fig. 2), we obtain the discone. The discone is to the bi-conical as an inverted ground-plane antenna is to a vertical dipole.

The discone is easier to build than a conical monopole primarily because no ground radial system is necessary. The high-current portion of the antenna is elevated above ground. The disk radius need be only about 1/12 wavelength at the lowest usable frequency, f_c.

Design

The antenna gets its name from the fact that it consists of a disk on top of a cone. The disk radius, r, is 0.08 wavelength at the cutoff frequency, f_c, and the slant height, h, is 0.24 wavelength. These dimensions are free-space values.

Above f_c, the swr drops from about 3.5 to almost a perfect match at f_{min}. In theory, the swr then remains nearly constant for several octaves. Above about the third harmonic of f_c, the maximum radiation begins to occur at considerable elevations above the horizontal; however, between f_c and $3f_c$ the radiation angle is very low and therefore is excellent for DX work.

At 10 MHz, 0.08 wavelength in free space is 7 feet 10 inches, and 0.24 wavelength is 23 feet 8 inches. The slant height of the cone is equal to the base diameter, making the pitch of the cone 30 degrees from the vertical. This value is not, however, particularly critical. Discones may be built with considerably larger or smaller vertex angles. The value of 30 degrees was chosen since it appears to be the most common value in discone design.

At VHF, discones usually are made from solid metal or screen. For a discone with f_c = 10 MHz, this would obviously be ridiculous. However, a wire cage will work very well at longer wavelengths provided the separation between the wires is small. The design scheme for the 10-to-30-MHz discone is shown in Fig. 3. A suggested list of parts is given.

Initial Construction

The center support mast for the HF discone is 23 feet 6 inches high. Aluminum tubing works very well for this purpose and is available in most hardware stores. Three eight-foot sections may be used, overlapping three inches at the junctions. The top section is one-inch O.D., the center section 7/8-inch O.D., and the bottom section one-inch O.D. The sections are best secured by slitting the end of the larger piece with a hacksaw and clamping the two sections together with hose clamps.

The cone consists of 32 lengths of wire. Uninsulated no. 22 wire is a good choice for this purpose. The wire need not be heavy; in fact, heavy wire will make construction very difficult. Each wire is approximately 23 feet 8 inches long and slants down at an angle of about 30 degrees with respect to the vertical mast. All the wires are joined at the base of the cone with an octagonal ring.

To form the base of the octagonal cone, eight stakes should be driven into the ground at a distance of 15 feet from the base of the support mast. (A ninth stack should be placed at the point where the mast base will be located, so the mast may be slipped over it when erected.) The eight cone-support stakes should be uniformly arranged in a manner such that lines from any two adjacent stakes

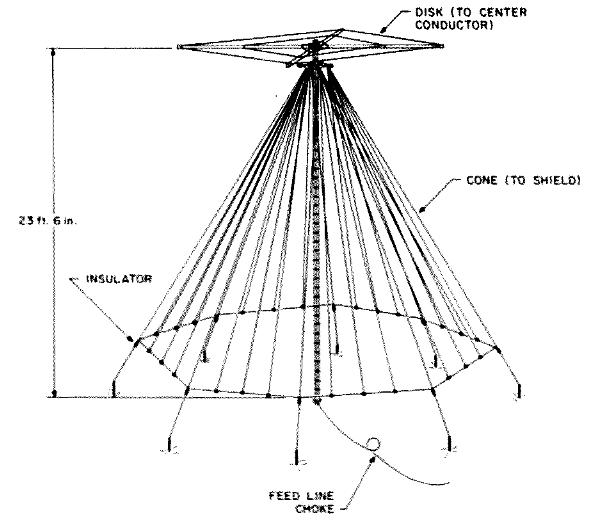


Fig. 3. Construction of the 10–30-MHz discone. The slant height is 23 feet, 8 inches; the square disk has a diagonal radius of 8 feet. The supporting mast is 23 feet, 6 inches high.

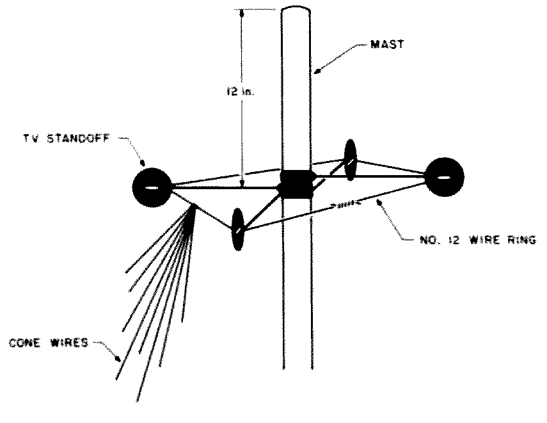


Fig. 4. The ring for the apex of the cone is constructed using no. 12 wire and four clamp-and-screw-type TV standoff insulators. The cone wires are attached in bunches of eight, one bunch to the center of each side of the square.

f_c, MHz	Bands covered, M	r, ft.	h, ft.	Mast*
3.4	80, 40, 30, 20, 17, 15, 12, 10	23.1	69.5	65
6.9	40, 30, 20, 17 15, 12, 10	11.4	34.2	33
10.0	30, 20, 17, 15, 12, 10	7.9	23.7	23
13.7	20, 17, 15, 12, 10	5.7	17.1	17
17.9	17, 15, 12, 10	4.4	13.2	13
20.5	15, 12, 10	3.8	11.5	11
24.0	12, 10	3.3	9.9	9
27.0	10	2.9	8.7	8

* Minimum heights, in feet.

Table 1. Discone dimensions for various frequencies f_c. (Values of f_c are chosen slightly below the lower end of the nearest amateur band.)

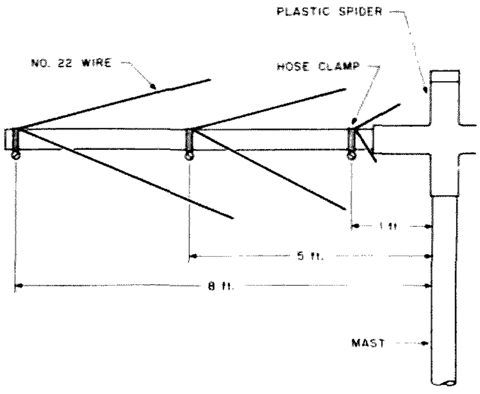


Fig. 5. Radial leg of square disk. Three concentric square rings of no. 22 wire join the radial tubing sections. The disk is mounted at the top of the mast using a plastic quad spider. The mast is wrapped with electrical tape to ensure a tight fit for the spider and also to insulate the disk radials from the mast.

would form a 45-degree angle at the center support point.

The cone apex is constructed as shown in Fig. 4. Four clamp-and-screw-type Radio Shack TV standoff insulators are mounted about one foot below the top of the mast. A length of no. 12 uninsulated solid copper wire should be run through the standoff holes and soldered at the ends to form a square. Caution must be exercised to make sure the ring does not short to the metal parts of the standoffs (and thus to the vertical mast).

To complete the cone, cut 32 lengths of no. 22 wire, each 24 feet long. Solder them in bunches of eight to the center of each side of the apex square. This prevents them from becoming hopelessly snarled when the mast is put up. Have someone hold the top section of the mast upright at its eventual location and fan the cone wires out along the ground in a uniform radial arrangement.

The "disk" is made from four eight-foot sections of one-inch O.D. aluminum tubing, a quad spider, twelve hose clamps, and more no. 22 wire. Insert the four sections of tubing into the spreader holes of the quad spider so that they form an X. In Fig. 5 we see how the wires are attached to the four radial sections of tubing to form the square disk. The wires should be pinched into a small U shape at each point where they are clamped to the tubing. Three concentric wire squares will result. The wires should be straight but not under strain since they will contract in cold weather. Mount the square disk at the top of the support mast, using the spider. Wrap the mast with tape to get a tight fit.

Parts List

Aluminum tubing, 7/8" O.D., 8' long	1
Aluminum tubing, 1" O.D., 8' long	6
Electrical tape, large roll	1
Ground stake, 2' long, minimum	9
Hose clamp, 1-1/4"	15
Insulator, porcelain or glass, 4"	8
Spider hub, plastic*	1
Standoff, TV type, clamp-and-screw	4
Wire, uninsulated no. 22, 1000 ft. roll**	1
Wire, uninsulated no. 12, 5-ft. length	1

*Propagation Products, 1855 Cassat Avenue, Jacksonville FL 32210

**Mouser Electronics, 11433 Woodside Avenue, Lakeside CA 92040

Putting It Up

Attach the center conductor of the coaxial feedline (RG-58/U, RG-8/U, or equivalent) to the center of the disk, using a hose clamp at the innermost exposed metal point of one of the radial tubing sections. Attach the outer conductor to the apex of the cone.

Have someone hold the top section of mast, complete with cone wires and disk attached, at the point where the mast is to be erected. Attach two of the cone wires from each bunch to adjacent radial stacks, using an insulator and four extra feet of wire. Raise the mast to its full height while keeping it vertical (a stepladder is almost a necessity to do this!). Tape the coaxial feedline to the mast as it is raised. Once the mast is fully extended, tighten the eight cone wires so that the mast is vertical and is effectively guyed by the wires—but don't pull them excessively tight.

Construct a ring of wire by connecting the eight cone wires together immediately above the insulators. This octagonal ring will be two or three feet above the ground. Then attach the remaining radial wires to the ring in uniform fashion all around. As with the other wires, do not pull them too taut. Each bunch of eight radial wires should run to two adjacent sides of the octagonal cone ring.

The feedline should be decoupled from the antenna at the point where the cable crosses under the cone ring. Otherwise there may be antenna currents on the feedline, with consequent problems. Wind the cable into a tight coil about five or six inches in diameter with 10 to 15 turns. This will choke off unwanted currents on the outside of the coaxial cable while leaving its performance as a feedline unaffected.

Testing

Once the discone is complete, you are ready to test it for swr. Results of testing at W1GV/4 are illustrated by the points in Fig. 1 at 14, 21, and 28 MHz. The swr is expected to begin rising at about 12 MHz. In theory, it should be about 3.5 at 10 MHz.

If the swr is a bit higher or lower than the values shown in Fig. 1, it is probably because of the ground conductivity (which can range from rotten to excellent) and also perhaps because of objects such as trees and electrical wires in the near field of the antenna. In some cases, sharp increases in swr may appear mysteriously at certain frequencies well above f_c. These cases are usually attributable to resonances in nearby objects such as other antenna towers and masts. Keep the discone as far away as possible from other antenna structures.

Since the discone is a vertically-polarized antenna and has a broadband response, it may pick up more man-made noise than resonant (narrowband) or horizontal antennas. A transmatch at the station end of the feedline will give the discone some selectivity, which should help reduce this noise if it is a problem. The transmatch also will reduce harmonic radiation. Hopefully, your transmitter has enough harmonic attenuation already, but the discone offers none at all.

If the swr is not reasonably low and flat (2 or less above f_{min}) and there are no known resonant structures nearby, check to be certain there are no open or short circuits in the system. If the cone apex ring should happen to touch the metal part of one of the TV standoffs,

the swr will change dramatically. The radial tubing sections of the disk should not short to the vertical mast inside the plastic spider hub. The cone wires should not come in contact with foliage and should be insulated from ground. All wire joints should be carefully soldered.

Conclusion

The discone antenna described in this article was built and tested at W1GV/4 in the summer of 1981, at which time I had the good fortune to be able to use nearly an acre of real estate. Results were as expected. The antenna performed very well for DX on 20, 15, and 10 meters. This is undoubtedly because of the low angle of radiation and the fact that the feedpoint is well elevated above the level of most nearby obstructions, especially houses (which are almost all single-level structures in Florida!). The discone should be a great convenience for multiband operators once we have access to six bands above 10 MHz.

Of course, there is nothing special about f_c = 10 MHz. Larger or smaller discones may be constructed to suit individual desires and needs. Table 1 gives the dimensions of the disk radius, r, and the slant height, h, as well as suggested mast heights for discones having various values of f_c. A discone for 80 through 10 meters is not out of the question if you have a 65-foot tower and a strong pair of legs! The disk, while quite large, could be supported with nylon rope trusses. A lot of wire would be needed for the cones! For serious low-band DXers, though, such a system could be more than worth the effort. ■

References

Bill Orr, *Radio Handbook* (nineteenth edition), Howard W. Sams & Co., Inc., 1972.

Reference Data for Radio Engineers (sixth edition), Howard W. Sams & Co., Inc., 1975.

Bill Clarke WA4BLC
Box 2403
Falls Church VA 22042

Two for Two

We respectfully offer a pair of radiators for the two-meter band so elegant, yet so simple, that you will kick yourself for not thinking of them first.

Many hams in the urban and suburban environment live in locations that preclude the installation of even the most meager of outside antennas. The reasons may vary from the transitory nature of the area to the more standard problem of rules and regulations. The latter, found where many hams reside, go by assorted names such as apartment regulations, townhouse covenants, deed restrictions, etc.

Of course, all these rules are "needed" to keep unsightly structures from appearing—structures that could be considered degrading to the uninitiated, thereby reducing property values. Naturally these rules were written with you in mind. That is you, the resident, to protect you. I sometimes wonder if these rules were not written by a landed gent who, having it all, wanted to be sure that all who did not have it, could not, and never would.

Well, just to make sure old Scrooge fails again, here are a couple of antenna designs for the ham who operates 2 meters either fixed or portable.

Fixed Antenna

The first antenna is just a plain 1/2-wave vertical. It's made from the foil stripping that is used for window burglar alarms. This material, which is glued to window glass, is available from Radio Shack. While you're there getting the foil, pick up a two-pole terminal block. The block is used with the window stripping and provides the connection point for your feedline.

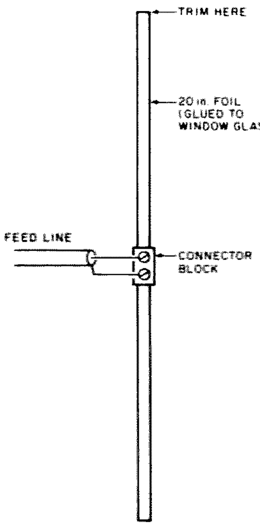


Fig. 1. Half-wave two-meter foil antenna.

The feedline can be RG-58 for power levels over a few Watts, down to RG-174, where a short feedline is needed that will be connected directly to a handheld. If using the RG-174, the run should not exceed 10 feet.

The elements are 20 inches to begin with, and must be trimmed for low swr (see Fig. 1).

Place a good VHF swr bridge in the transmission line at the transmitter. Key the transmitter in the middle of the band, say about 146.000, and read the swr. It should be more than 3:1. Then trim 1/8 inch from both foils (from the ends that are not connected to the terminal block). Now key the transmitter again; the reading should have gone down. Repeat this process until the reading is below 1.7:1.

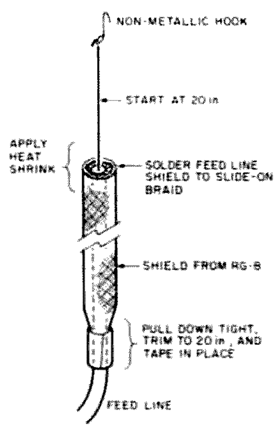


Fig. 2. Half-wave two-meter flexible antenna.

When 1.7:1 is reached, key the transmitter at 144.000 and note the swr. If the swr is above 2:1 at the low end, trim another 1/8 inch from both foils and recheck the swr. The object is to have an swr below 2:1 over the entire band.

Portable Antenna

For portable use, this version is built from coaxial cable and can be rolled up and put in your jacket pocket. The antenna, often referred to as a "hypodermic antenna," when in solid form for use on the lower bands such as 10 or 15 meters, is properly called a coaxial vertical antenna. The primary purpose of the antenna is to give the traveling ham a good radiator for use with his hand-held.

The antenna and feedline are one piece of RG-58 and should be 8 to 10 feet in

length. Install a BNC connector at one end of the feedline (or whatever connector your HT uses).

Now carefully remove the outer sheath and braid from the last 20 inches of the remaining end, now called the radiator. The sheath and braid will be discarded. Cut 24 inches of RG-8 and carefully remove the sheath and braid. Slide the braid over the end of the radiator and solder as noted in Fig. 2. Discard the sheath.

Now stretch the braid out as much as possible and trim it to 20 inches in length. Tape it in place. Attach a nonmetallic hook to the top end of the radiator and hang the antenna in a location where it is free of obstacles for at least 24 inches. It should be vertical, or nearly so. A good place might be from a ceiling light.

Place a good swr bridge in the transmission line and key the transmitter for 146.000. The swr will be over 3:1. At this point, trim 1/8 inch from the radiator and repeat the test process. When the swr drops below 1.7:1, you have completed the testing. If you cannot get the swr down to 1.7:1, trim 1/4 inch from the bottom end of the RG-8 braid and recheck the swr.

After the trimming is completed, apply heat shrink over the solder point (center of the radiator). This will look neat and will protect the connection.

This antenna works particularly well when hung from the curtains in a motel room or from a branch of a tree. The antenna can be rolled up and tucked away when not in use.

I have not delved into heaps of radio theory since these are supposed to be easy projects. Just follow the instructions and you'll have working antennas that will perform like bandits. ■

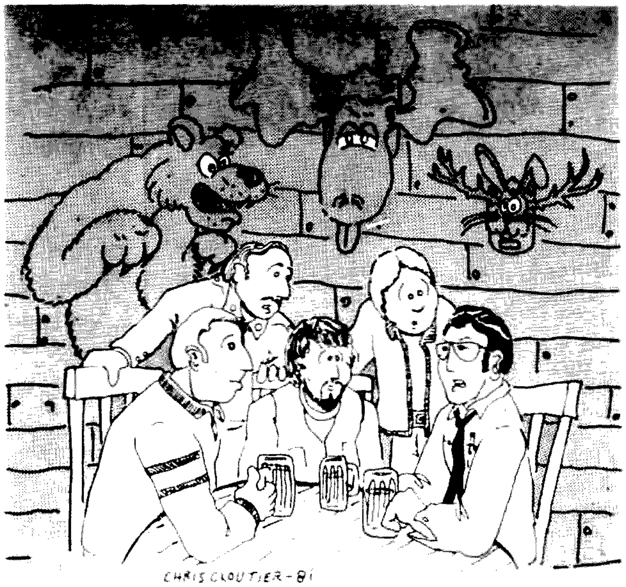
George M. Ewing WA8WTE
PO Box 502
Cheboygan MI 49721

The Snake with LED Eyes

A tall tale from the Antlers—where the decoration is strange and the stories are even stranger.

It was a quiet Friday evening more than a month from the St. Patrick's Day craziness, and I was sitting at my favorite table under the canoe at the Antlers, listening to some VE3s chattering on the local repeater and savoring an oversized can of Australian beer. Bill Tomlinson, a local newspaperman who also is a ham, came in with a couple of cronies from the Coast Guard base, spotted the empty seats at my table, and sat down. He motioned for two more of the jumbo 807s, and while the two other fellows were ordering giant Paul Bunyan hamburgers, I quizzed him on how things were down at the office, how was the new rig—all the usual trivia. He was giving body language signals that fairly shouted that he had another outrageous adventure to relate, but he was being cagey, waiting for someone to coax it out of him.

Rolly Macksohn, president of the local repeater group on the Michigan side of the border, came in a few minutes later with three or four kids from a night class in computers that he was teaching. They pulled the next table out from its usual place under the stuffed moose's rump on the ceiling and pushed it up to ours, dragging along chairs as needed. The waitresses brought food and a couple of large pitchers of domestic beer. Tomlinson took a deep drink, cleared his throat noisily, and looked around. One of the newcomers was holding a Tooth lager beer can to his left ear, listening intently. I thought at first the kid was listening to the bubbles fizzing, but then I saw a VHF rubber duckie coming out of a BNC connector in the center of the can lid, and I knew this was the right sort of audience for one of Bill's yarns. Sure enough, he took another big pull on that oversized 807 and started right in.



I knew this was the right sort of audience for one of Bill's yarns.

"New stuff at the paper? Well, you might say that. About three or four weeks back, we were having one of those really terrible, no-news days, you know, when there's nothing on the photo wire but pictures of cute children making snowmen, and a giant icicle at some college dorm in Houghton is front-page copy. Tim Gallock was walking around with his stomach out and his cheeks puffed, doing Lou Grant imitations. One of those days. Mary Chen KH6DDD comes into the office and tells me we have a special assignment. Now this is a little scary, because while I like working with Mary and

she's utterly gorgeous, she also has this NHL-forward boyfriend who is insanely jealous and has more stitches in his face from fights than my word processor has failure modes.

"Anyway, she really liked a piece I did a few months back on those want ads claiming you can make hundreds of dollars an hour stuffing envelopes for some company. It was a really funny exposé. The readers loved it, and I'm still getting junk mail like you wouldn't believe. We decided to go after the want ads again, this time the ones in the back of the mystery and science fiction magazines advertising 'Beautiful Puerto Rican girls desperate for American Boyfriends,' and the ones selling antigravity, 200-mpg carburetor secrets, and UFO photos—stuff like that.

"We divided it up, Mary taking the mail-order girl racket first and me going after the crackpot inventions, then we'd switch off. I had a blast at first, sending off the newspaper's stamps and petty cash to all those ads. A lot were thinly-disguised pyramid or chain letter gimmicks, or routine automotive mousemilk that probably wouldn't actually wreck your car's engine, but wouldn't give you any miracle mileage, either. Then I ran into an ad that was repeated in all the magazines printed by a big publishing house; it must have been sold as a package deal. The ad said:

> Tired of Rotten QRM?
> Outlaw Kerchunkers
> Running You Ragged?
> Now There's Relief at Hand
> Try Our Computerized ID
> And Call-Finder Kit
> And Give Those Rf Turkeys
> The Ol' Wouff-Hong!
> Send $39.95 to Weasel Net, Inc.
> Benson Arizona 85602
> Money Back in 30 Days
> If Not Delighted!

"This one really had me wondering. This was not, I repeat not, an amateur-radio magazine, but the ad was plainly aimed at us hams. Also, forty bucks was more than the usual petty amount the paper had authorized. I had to argue for a few minutes with Fenton, the guy at the city accounts desk, but he finally agreed to go along with it as long as we paid by check and kept a careful record. I was afraid that the ad would turn out to be just misleading, not downright crooked, and that I'd get some hastily-put-together bag of junk ICs that might actually act as some kind of direction finder or callbook file; the ad was, after all, a little confusing.

"Three days after I dropped the check in the mail, the UPS van delivered three big cardboard cartons, each of them maybe the size of a DX-100. Mary and I cleared out an old meeting room over in the printing plant and laid the stuff all out on a big conference table. Half the bulk of the packages was those plastic foam peanuts they use for packing, but there was also a manual the size of a Grand Rapids phone book and one heckuva lot of parts.

"There was a motherboard, a fancy aluminum card cage, a power supply that could have run a sizeable linear, and a dozen circuit boards, all crammed with expensive-looking parts. I began to smell a rat the size of Sumatra. There must have been a couple of thousand dollars worth of parts there, fancy CMOS computer ICs, hundreds of gold sockets and precision trimmers, and this one monster chip: a slab of what looked like solid sapphire the size of a playing card and a quarter-inch thick. Any of you ever see a 1024-pin DIP socket before?"

There were several laughs and shakes of the head around the table. Several jumbo baskets of fries were being passed around, and more pitchers of beer. A half-dozen other regulars had come over to the tables from the corner, over by the stuffed boa constrictor with the LED eyes that light up at closing time. The crowd was beginning to get in the way of the waitresses, though they didn't seem to mind. Bill accepted a fresh cannister of Aussie brew from somebody, refilled his glass, and continued.

"It took us three days, working almost full time, to assemble the blasted thing. The manual was pretty explicit as to how things plugged together, but I still was having trouble figuring out exactly what it was supposed to do. Also, I was worrying about spending so much time in a secluded room with such an attractive YL. I finally invited the boyfriend with all the scars and her both out to dinner and over to the plant afterwards. He turned out to be a pretty nice guy, a VE2 from someplace near Montreal, and a computer freak to boot. He was fascinated by the gizmo and helped me haul all the hardware over to my shack for the first on-the-air test.

"The next morning was a Saturday, and after a pot of coffee and lots of blueberry pancakes, we all met at the shack: Mary and her beau, two guys from the newspaper, and myself. First we ran coax to two antennas. The instructions required two vertical antennas at least a quarter-wavelength long on the lowest frequency to be used. Another plug ran to one of those flat membrane keyboards like they use in the cheaper home computers, and another cable ran to the UHF input jack on a TV. I hooked it up to a big color console that I had been fixing for a neighbor.

"When we turned on the power, a whole regular questionnaire appeared on the TV screen, with blanks to be filled in by typing on the keyboard. I was beginning to worry. Obviously, there was a lot of expensive computer stuff here, and it was going to really hit the fan when those people in Arizona realized that they'd sent it to me by mistake for forty bucks.

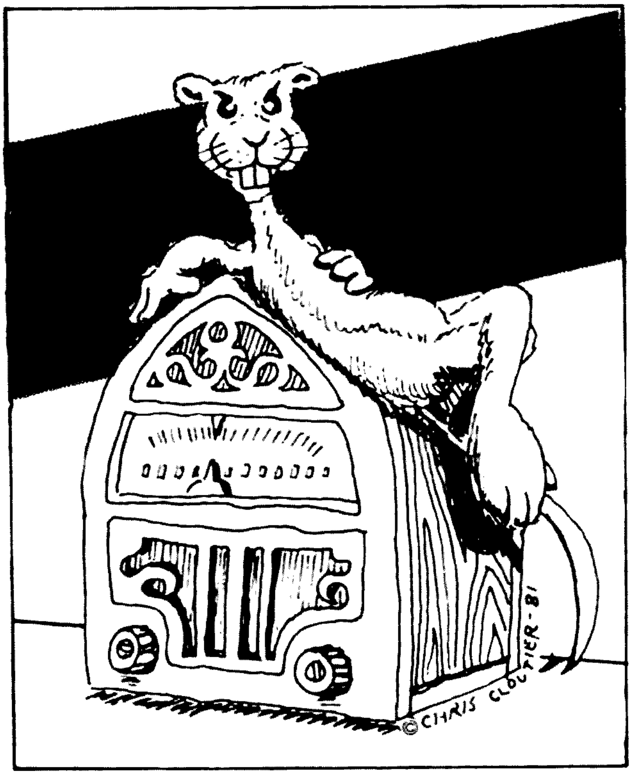
"The questions on the screen were really detailed, but they made sense, sort of. I typed in the model number of my rig and plugged the cables provided into the antenna, vfo, and headphone jacks. Next, the screen demanded the

". . . we all met at the shack: Mary and her beau . . . and myself."

exact latitude and longitude of the antenna array, the spacing, and the exact length of the coax to each in millimeters. Well, it so happens, there's a surveyor's bench mark in the corner of my lot, so that wasn't hard, and Steve, the VE2, volunteered to go out in the freezing cold with a measuring tape. While he was getting the measurements, I warmed up the rig and then tuned to zero beat on WWV, just as the instructions said. Steve soon came back in with the measurements required, and we had some more hot coffee while Mary typed the numbers in.

"Next came the phone connection. I was a little uneasy about bringing Ma Bell into the picture, but I did as the instructions said. I plugged the little modular jack into the wall, piggyback with the regular phone cord. Then I dialed the toll-free 800 number in the manual. There was a series of clunks and beeps, and then another dial tone. I dialed the second number, this time using the touchtone™ pad on the flat keyboard. There were more beeps and clicks, a single ring, and then a strange, robot voice that said, 'Good morning. Password, please.'

"I typed in the characters, 'WSLNET.COM' on the keys, and there was a final click. The color screen sprang to life, the questionnaire replaced by something out of the control panel of a movie spaceship. I tuned the knob on the rig slightly and realized that what I was seeing was an incredibly detailed panoramic display of the whole HF spectrum. The bands were displayed in different colors, and the exact center frequency of the receiver passband was displayed in video numbers next to a vertical cursor that moved as I twiddled the dial. Not only that, but there was a compass heading in the upper left corner that changed



". . . and there's this little cartoon picture of a weasel sitting on an antique radio."

as I rotated a knob. I tuned to the twenty-meter phone band, and sure enough, the signals on the display increased and decreased in strength, just like swinging a beam. The box was electrically rotating the lobe of the antennas without physically moving any parts.

"Certainly this gadget was worth more than a mere forty bucks. It was also one heckuva direction finder, and I resolved to write a nice letter to the people at Weasel Net to apologize for having thought them charlatans. The newspaper exposé was out, but perhaps I could sell an article to one of the ham or computer magazines and get in a free plug for so deserving a company.

"As we sat in the shack, tuning across the band, I ran into one of those very situations that the ad had mentioned. I had been listening to one of those maritime mobile nets on the high end of twenty, watching the various signals check in from different parts of the DX world. Steve showed me the controls that expanded the scale of the panoramic display so that ten kHz or so was spread over the whole screen, and you could see in detail the speech envelope of each station. Suddenly some clown was right on top of them, calling 'CQ contest, CQ contest,' over and over again. It was pretty obviously deliberate jamming, as the lid never once gave his callsign, and once or twice wisecracked back at the net control station who asked him to QSY.

"I could tell that the signal was coming from the south, probably skip from southern Georgia or Florida, and I had a fairly good bearing on the compass display. I asked Mary how I was supposed to get a real fix on a signal. She showed me how to use a light pen to tag the particular waveform of the QRMing signal and touched a button. The signal turned a bright orange on the screen and stayed that color even on successive transmissions. Next, I typed in the command that Steve had found in the manual:

'A:WSLNET.PAN> WSLNET.RDF(V)'

"The panadapter display disappeared, and the screen was filled with hexadecimal numbers. The box plugged into the still-open phone line beeped and kerchunked, and there was a long blast of what sounded like high-speed Teletype®; a lot of information was coming in from somewhere. The numbers on the screen were replaced with a beautiful, four-color map of a residential suburb and a latitude and longitude display right to the second in the upper right-hand corner. This apparently was the source of the QRM. The US Geodetic Survey numbers in a corner of the screen allowed us to identify a suburb of St. Petersburg, Florida, and a fuzzy red circle, a block or so in diameter, showed the source of the intruding rf.

"Steve, who had been leafing quickly through the manual all this time, typed out the characters:

'WSLID.DIR'

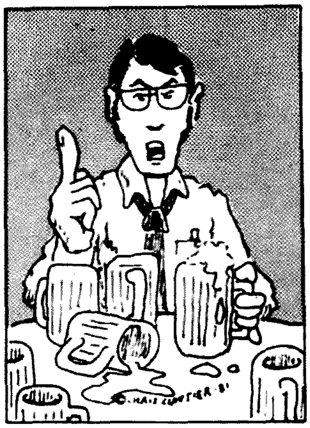
The picture shifted to what looked like one of those satellite or high-altitude U2 photos, blown up until it's just a trifle fuzzy. You could just make out the corner house in the block that had been circled on the map. After a few seconds, a new version of the picture was written slowly on the screen, one line at a time like a slow-scan TV frame or one of those NASA photos of Saturn. After a few passes, the picture was greatly improved, though still at the same scale. Now you could clearly make out the details of the large, ranch-style house, an Oldsmobile Toronado in the driveway, and a large triband beam on a tower in

the backyard. The right-hand margin of the picture had a printed listing, address and phone number, and a facsimile of an amateur-radio license made out to one Wilbur Glemp, 1524 Brightwaters Boulevard NE, St. Petersburg. This was apparently the location of the lid who was still calling 'CQ contest, CQ contest, anybody out there for another contest?' over and over as we listened.

"Steve showed Mary another listing in the manual, and she typed it in. The picture, which had been in slightly fuzzy color, now switched to black and white, but with greatly improved detail. Several more passes with the computer enhancer didn't do much to improve the resolution. The telephone line beeped and warbled some more; I wondered just where the heck all this information was coming from. A weather satellite perhaps? Old cartographic photos? It was hard to say.

"I had one of those big magnifiers on a pantograph arm on the end of the workbench. I turned off the little fluorescent light and positioned the lens over the TV screen. Now I could just barely make out a man seated at a table in the patio behind the house in Florida. There was a ham station laid out on the table, three boxes, and what looked like a linear on a little cart. You couldn't quite tell if the rig was a Collins S-line or some other kind of radio, partly because of the fuzziness of the scan lines on the color TV and partly because of a folded beach umbrella on a stand over the table.

"You could see the man at the table move, but it was a trifle jerky, somewhere between true slow-scan and early Project Mercury astronaut films in speed. This was great, but how could I tell that it wasn't a hoax and that this



". . . some of you think I made the whole thing up . . ."

fellow sitting there in a loud shirt with a microphone in one hand and a can of beer in the other wasn't just a clever cartoon dreamed up as a gag by the Weasel Net folks out in Arizona? The ham license looked genuine, but I was surprised to see that it was one of the new two-letter prestige calls. The rest of the picture didn't quite jibe, either. The house was obviously in a nice neighborhood, right across the street from Tampa Bay, with yachts, expensive cars, and lovely Spanish-style homes all around. Why would somebody who had it made be hassling a regular traffic net that was eminently useful and constructive?

"I decided to try an experiment. I picked up the phone and dialed the Florida number on the screen. As the number rang, the jamming voice, which had been chanting 'Rotten contests, rotten contests, rotten, rotten, same old contests . . .' broke off, said, 'QRX one, fellas,' and the jerky figure on the screen reached for the phone and answered it. 'Hello?'

" 'Mr. Glemp?' I said.

" 'Yes?'

" 'You probably don't know me, but my name is Tomlinson, and I work for one of those government agencies famous for its initials. I wish you'd cut it out, Mr. Glemp. Those fellows are just doing their public-service duty, and breaking the law could get you into a lot of trouble. I'm a ham, too, and I've got better things to do with my time than sit in a stuffy federal courtroom in Pinellas County. Knock it off, and maybe we'll work you on the air sometime. 73.' And I hung up the phone.

"The little figure on the screen hung up too, turned off the rig, and started staring around in all directions, even up at the satellite or camera or whatever was the source of the video. Then he started frantically disassembling the station, carting all the boxes one by one into his garage. It was comical and pathetic at the same time, and I was reminded of the famous comedy routine by Bob Newhart or Bill Cosby, or whoever it was, about the little brat who answers the phone, and the man calling says he's God and warns the kid not to hang up.

"I spent the rest of the day playing with the rig, and you'd be surprised how many people do their hamming outdoors where they can be seen. I listened in on a famous ham on a tiny South Pacific island while he tinkered with his new solar-power plant, Boy Scouts gathered around a pup tent portable on a mountainside, even a lovely YL who checked into a CW traffic net while sunbathing in privacy (or so she thought!) beside her swimming pool in California.

"There weren't really that many lids breaking the rules; most hams really are pretty well-behaved, and I just didn't have the stomach to turn the thing on eleven meters. A half-hour trying to copy the code practice from W1AW was bad enough.

"The following Monday, I had the guys in the shop print up some official-looking pink-paper forms, all covered with eagles and lightning bolts and important-looking seals, and I had a friend who lives in Langley, Virginia, mail out a batch or two to deserving idiots as a friendly warning, and the QRM died down amazingly for a while . . ."

"How about the kerchunkers?" the kid with the rig in the beer can interrupted Bill. "Was the thing any good on VHF?"

"It surely was, but, of course, there were limitations. Listening to the output channel of a repeater didn't do any good; you had to be able to hear the signal direct, and the setup wasn't exactly very portable. I suppose we could have built it into a van and driven around with a mobile telephone link and a whole lot of surveying gear, but it just didn't seem all that practical. Then, too, your average repeater kerchunker gives it only an occasional hit for a second or two, which makes him pretty hard to pin down. I suppose in the case of frequent, extensive jamming by a real commode-brain, or in the case of clandestine remote transmitters deliberately planted as a challenge to the repeater sponsor, the thing would have been worth its weight in IRCs. We don't have any of that sort of crap around here, thank God. It's not like those stories you hear about California."

"Amen . . . You said it, man . . . Sure 'nuff . . ." There was murmured assent from around the table.

"Hey, Bill," Rolly broke the sudden silence that had fallen, accompanied by several members of the group signaling for more beer and fries. "You still have that marvelous machine? I'm certain most of the fellas here would love to get their hands on that sort of fancy hardware and do their little bit to help promote law and order on the airwaves." There was

more muttering and widespread grins; people could see it coming.

"Ahhh, Rolly, would that I did!" You could see the wheels grinding as Bill Tomlinson thought up his excuse for not being able to produce the marvelous machine. "I kept that li'l rascal for about three weeks, and by the end of that period, there was a noticeable nadir in stupidity on the low bands, anyway. It's still down a bit, to this day. Then I began to get a little paranoid. I kept wondering who was behind these Weasel Net fellas, and why anybody would lay out the money and engineering talent to set up all that equipment, all over the country. There had to be hundreds, maybe thousands of those machines, and satellite links and heaven knows what else. Who stood to profit? The government, the CIA, who? Maybe it was a sneaky way for the FCC or somebody to get a lot of volunteers to help police the spectrum, maybe the military, or even some foreign power was involved. An array of hundreds of HF receivers all spread across the whole country and all tied together with computers and phone lines is a pretty powerful piece of technology. Maybe I was unjustly paranoid, but a number of little things began to really bother me.

"First off, that phone line was open all the time, both ways. My regular phone still worked okay, but every so often, I'd pick up the handset late at night, say, and there'd be strange clicks and funny teletype noises. I never got any extra phone bills, but still it bugged me. And then I'd go into the shack and find the doggone rig on, when I swore that I'd turned it off the night before, or I'd leave the shack for a while to get a cup of coffee or an 807, and I'd come back and find the dial on the rig set on a different frequency. One time I was working this G3 buddy on ten-meter phone, early in the morning, my time. That ding-blasted Russian woodpecker comes on with its doggone pocketa-pocketa noise, and I thinks to myself, I'm gonna see where that so-and-so really comes from, whether it's Russia, or Iran, or wherever. So I went through that whole routine, like I did that time with that Glemp turkey in Florida. Only, when I typed that 'WSLNET.RDF' command into the machine, the screen turns bright red, and a printed notice appears that says, 'Sorry, but we are not allowed to divulge that QTH at this time. Thanks for the good effort, and hang in there, OM!' and there's this little cartoon picture of a weasel sitting on an antique radio.

"Finally, I decided that enough was enough. I took the rig all apart, clear down to its component boards and modules, making careful photographs of everything as I went. Then I ran that whole manual, every last page of it, through a Xerox machine at work, two copies of everything, and gave one set to a friend to put in a safe place. Then I boxed the whole thing up, went down to the post office, and sent it back to Arizona, insured and return receipt requested. The very next morning, I received my original check back; it had never even been cashed! I found enough other stuff in the screwy want ads to do a fairly humorous piece for the paper. Mary did a separate, serious article about the mail-order Oriental and Latin American bride agencies; it turns out that just like massage parlors, a good many of them are perfectly legit, though they tend to advertise in a slightly sleazy, suggestive tone to keep the cards and letters coming in. Mary and Steve are going to be married right after the Stanley Cup playoffs, and they are already planning to generate lots of harmonics. Those old jokes about non-Caucasian hockey players may not be very funny in another twenty years or so. Ooops, there goes last call!"

There was a cacophony of bells, gongs, sirens, steam whistles, and gun shots as the clock over the bar lit up for last call. The eyes on the snake lit up, and the stuffed grizzly bear came out of the women's washroom on its roller skates and rolled up to the bar making tinny growling noises. The bartender patted the bear and threw a couple of switches behind the cash register. The bear rolled around the room, growling more, and rolled back into the women's john.

Bill got up to go. He took a handful of 5" × 7" photographs from his inside coat pocket and tossed them on the table next to a pyramid of Australian beer cans.

"I realize some of you probably think I made the whole thing up, just so I could mooch a couple of free drinks while I told you a bunch of lies, only of course you're too polite to say it. Here you go, look 'em over. I've got plenty more prints. Good night!" and he walked out the door, ducking his head to miss the stuffed coyotes and the airplane propellors hanging from the ceiling. Two guys I'd never seen before got up from a corner table under an old Irish flag and followed him out.

There really were some beautiful photos of fancy-looking electronic gear, but somebody set them down in a puddle of spilled Foster's on the table, and they suddenly fizzed, smoked, and turned black. I'm going to ask Bill for a couple of those passwords and phone numbers, next time I see him. ■

Harry D. Hooton W6TYH
1420 Shamrock Lane
Lincoln CA 95648

Up, Up, and Array

W6TYH's hybrid collinear will rocket your signal to new heights!

When an antenna conductor is cut for half-wave resonance at a given frequency, it is called a dipole. When a dipole is operated at a frequency twice that at which it resonates as a dipole, its radiation characteristics change and it becomes a simple, rudimentary, bi-directional beam antenna or array. While the vertical directivity remains the same as that of the dipole, the horizontal directivity can be concentrated into a sharp pattern, as shown in Fig. 1.

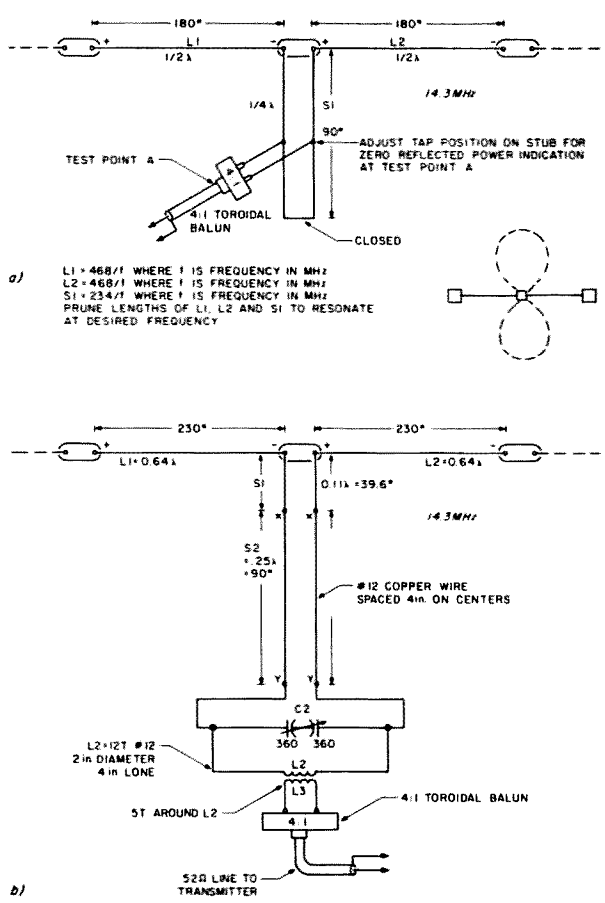


Fig. 1.

In the past, the array shown in Fig. 1(a) was first called a *full-wave, centerfed zepp antenna*. Later, it was dignified by calling it "a pair of half waves in phase," or "collinear" antenna. In its simple form, it consists of a pair of radiators each 180 degrees long, as shown, and fed at the center with an open wire, usually some definite number of quarter wavelengths long. The simple double-zepp antenna has a a bi-directional gain over a half-wave dipole of about 2.8 dB.

If each radiator element length is increased to 230 degrees, the radiation pattern becomes sharper in the horizontal plane and the gain in each direction increases slightly to about 3.0 dB over that of a half-wave dipole.

The array with the two 230-degree elements is usually referred to as an extended double-zepp antenna and will be found in most antenna handbooks. These antennas generally are used on the 75- and 40-meter bands but will work well on the 20- and 15-meter bands for distances of up to 2500 miles or so.

An Improved Extended Double Zepp

Today, most hams prefer to use coaxial-cable transmission lines mainly because porcelain spreaders have become almost nonexistent, but also because the long open-wire lines are considered unsightly. The array shown in Fig. 1(b) uses the conventional open-wire tuned-feeder type of transmission line, a quarter wavelength long between points X and Y. The 4:1 balun couples the resonant circuit to the 52-Ohm line. I used this antenna on 14.3 MHz for several years with good results for medium-distance contacts across the USA. However, the feed system was an eyesore, particularly to the XYL, and the system was changed to allow coaxial feed all the way up to the radiators.

As most hams know, a gain difference of 0.2 dB is peanuts and will not be apparent in the strength of a received signal. If the radiator elements are made 180 degrees long instead of 230 degrees, a tuned circuit can be inserted at the center feedpoint and the 52-Ohm coaxial line can be coupled to this circuit through the 4:1 balun as before. It should be understood distinctly that this circuit is *not* a "trap" in the usual sense but a parallel-resonant circuit tuned to the operating frequency. Each radiator section is 180 degrees (half wave) long at the operating frequency. The construction and adjust-

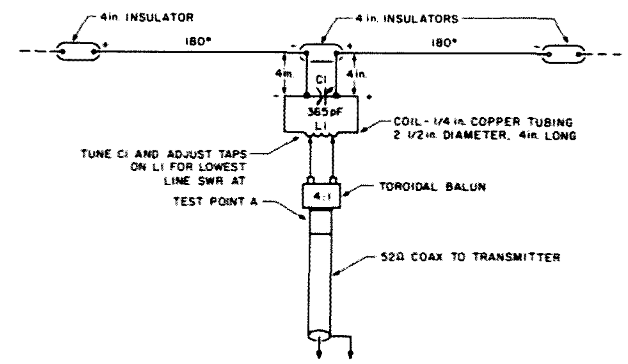


Fig. 2. Coupling circuit moved to the center of the antenna.

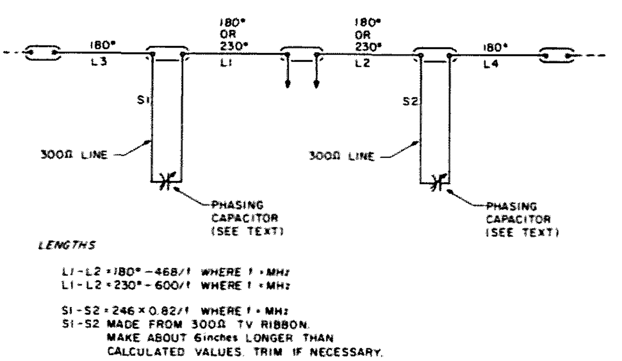


Fig. 3. Added phasing stubs. Center elements may be 230° long (extended double zepp) or 180° (two half waves in phase) collinear. See text.

ment of the resonant circuit will be covered in detail later.

Adding Additional 180-Degree Elements

If we add two more elements to the extended double zepp, as shown in Fig. 3, the width of the horizontal radiation pattern will be reduced and the gain in each direction will increase to about 4.5 dB over a half-wave dipole operated under the same conditions of height and power input. In the past, it has been the usual practice to use open-wire line for the quarter-wave phasing stubs. When constructed from No. 12 or No. 14 copper conductors and porcelain spreaders, the stubs are unsightly to most people and tend to whip around in the wind. After a short time the two conductors are not equally spaced from top to bottom, and the system becomes detuned. If the stubs are made of good-quality 300-Ohm line sections, the spacing will remain constant under all conditions and the appendages are not so noticeable.

In the past, it has been the custom to prune the length of the stubs to resonate the system and produce the correct phase relationship between the radiator elements. If the stubs are made equal to 246 × 0.82/f, where f is the operating frequency, with about 6 to 8 inches added to the calculated length, a variable capacitor may be inserted in series with the stub conductors as shown in Fig. 3. Each capacitor can be adjusted for correct system resonance and phase. The capacitors for a 20-meter array are about 360-pF maximum capacitance and were obtained from old tube-type table-model AM radio receivers.

To adjust the capacitors for correct resonance and phase, I used a battery-operated portable shortwave receiver (the GE model 7-2990) for a field-strength meter. The receiver is placed about 200 feet (or more) distant from the "front" or "back" of the array and the array is excited with about 5 to 10 Watts of rf power at the operating frequency. Have someone watch the S-meter indication on the receiver. Make certain that the receiver is tuned for peak meter indication. Simply adjust each phasing capacitor for *maximum indication on* the receiver S-meter. Carefully remove each capacitor without disturbing its capacitance setting. In the lab, measure or otherwise determine the adjusted capacitance of each capacitor. Select a mica dielectric *fixed* capacitor of the same value as that of the adjusted variable. Insert the fixed capacitor in the stub in the same position as that occupied by the variable. Check the field strength as indicated by the receiver S-meter.

If you wish to resonate and phase the array by adjustments in the 300-Ohm line stub lengths, make the stubs about 6 to 8 inches longer than the calculated length as described above. Using a grid-dip oscillator tuned to the operating frequency, couple the shorted end of each twinlead stub to the grid-dip oscillator coil. Prune the length of the stub, a half inch at a time, for the greatest dip indication on the gdo. When each stub has been adjusted in this manner, short the two stub conductors together and solder the connection. Tape with plastic electrical tape to keep out moisture.

How to Eliminate Phasing Stubs

The purpose of the phasing stubs is to shift the phase of the rf current and voltage so that each 180-degree radiator section will be in phase with that of the others. In other words, the rf currents in all radiator elements must be flowing in the same direction at any given instant. If you will check your basic theory of resonant circuits, you will find that in a parallel-resonant circuit, *at resonance*, the two rf voltages (or the two rf currents) are 180 degrees out of phase with each other. The rf voltages at the upper end of the stub are also 180 degrees out of phase with each other. Therefore, there is no reason why a parallel-resonant circuit cannot be substituted for the stub and the radiating system will never know the difference.

When I first discussed the idea of using the parallel-resonant circuits instead of the stubs, a couple of antenna experts insisted that the tuned circuits would "trap out" the current to the end radiator elements and that the system would not load. If you have any doubts, adjust the system as described later, feed about 25 Watts of rf power to the system, and then touch a neon lamp to each end of each 180-degree radiator element. The lamp will light up with equal brilliance at all high rf voltage points.

The gain of the array will be maximum when the phase-shift circuits are resonant at the operating frequency. To obtain the highest possible gain, the resonant circuits should be made with a high Q. However, if the tuned-circuit Q is made excessively high, the bandwidth of the system will be reduced to about 100 kHz on the 20-meter band. If the Q is made relatively low, the gain will be reduced somewhat but the array can be operated over the entire 20-meter phone band without deteriorated performance or an excessive rise in the 52-Ohm-line swr.

For a high-Q 20-meter system, the inductor, L1, consists of 3 turns of 1/4-inch copper tubing, 2-1/2 inches in diameter and spaced to a length of about 4 inches.

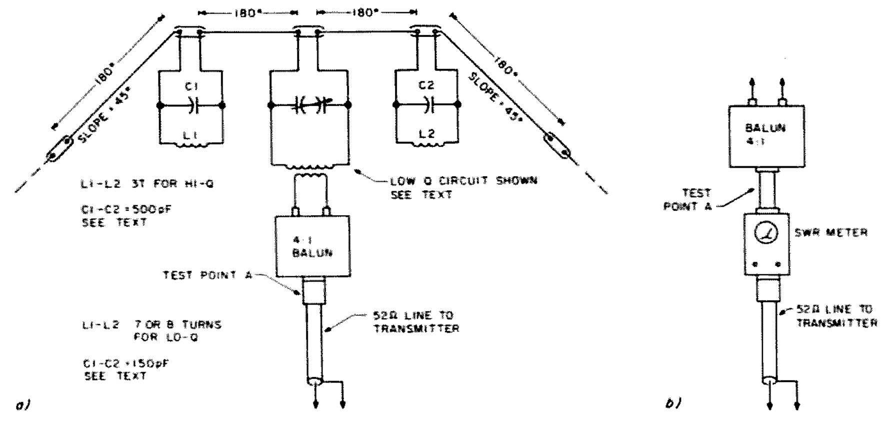


Fig. 4.

The capacitor, C1, is a high-voltage ceramic type with a capacitance value of 500 pF. The circuit is resonated by squeezing or spreading the turns of the coil for resonance at the desired operating frequency (14.3 MHz in our case). If constructed in this manner, the circuits may be inserted in the antenna system without placing them in weatherproof enclosures. (At W6TYH, the system does not indicate any detuning even in wet weather.) It will be necessary to readjust the resonant circuits after they are inserted in the system, since the high-Q units are somewhat sensitive to the height of the radiators above ground.

For a low-Q system, make the capacitor values about 150 pF each and each coil about 7 or 8 turns. Spread or squeeze together the turns until resonant at the desired frequency as indicated by a grid-dip oscillator. When adjusting either the parallel-resonant circuits or the stubs, as described above, always monitor the gdo frequency with a calibrated receiver. The gdo frequency will be "pulled" by the coil adjustment. Both tuned circuits must be adjusted and installed in the system and then we are ready to make the feedpoint matching adjustments.

Matching Adjustments

The antenna system will be easier to load if the parallel-resonant circuit at the center is made relatively high Q. If L1 is made from 1/4-inch copper tubing, for a 20-meter antenna, it will consist of 5 turns 2-1/2 inches in diameter, spaced for a length of about 4-1/2 inches. The variable capacitor, C1, is a 150-pF double-spaced type removed from an old war-surplus transmitter. The output connections from the 4:1 balun are tapped on L1, one turn each side of center. The swr meter is inserted in series with the 52-Ohm line, as shown in Fig. 4(b).

To start, turn off the sensitivity control on the swr meter and place the selector switch to indicate reverse or reflected power. At the transmitter end, feed about 5 Watts of unmodulated rf carrier to the 52-Ohm line. The frequency must be exactly the same as that to which the phase-shifting circuits were tuned. With the balun output terminals connected as described above, set the swr meter selector switch to forward and adjust the sensitivity control until the indicator reads exactly full scale.

Throw the selector switch to reverse and rotate C1 for the deepest indicated null, or dip. If the lowest null indication is not zero, move the balun output connections toward or away from the center of the coil, L1. It will be found that the correct points on the coil for a perfect match (zero reflected power) at the balun input terminal will be very critical. The tap adjustments will affect the resonant frequency of the circuit, L1/C1, and it will be necessary to readjust C1 each time that the tap positions are changed. The resonant circuit, L1/C1, should be placed in a waterproof enclosure. A large plastic sheet may be placed over the entire assembly, including the toroidal balun, and tied securely with nylon twine.

The arrangement shown in Fig. 6(a) uses a 12-turn coil made from No. 12 copper plastic-covered household wire. The coil diameter is 2

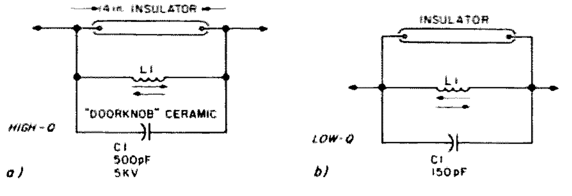


Fig. 5. Phase-shift circuit details. L1 in a) is three turns 1/4" copper tubing, 2-1/2" diameter, 4" long. Spread or compress turns as indicated by arrows to resonate circuit to desired frequency. Narrow bandwidth but easier to load. L1 in b) is seven to eight turns of same-dimensions tubing, spread or compressed, providing greater operating bandwidth.

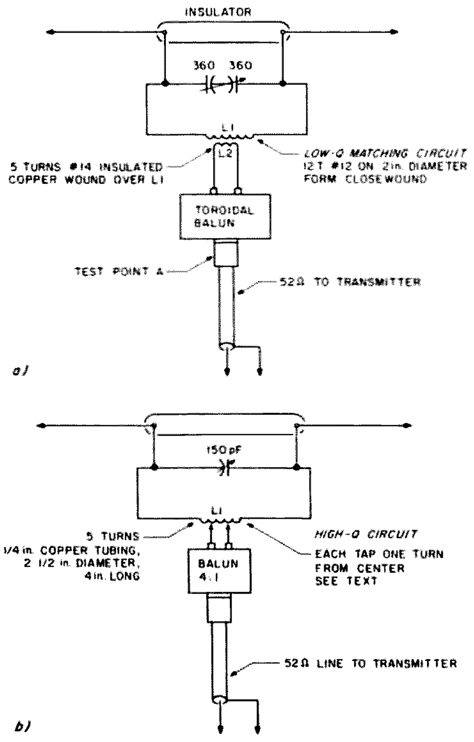


Fig. 6.

inches and the turns are close-wound on a Bakelite™ tube. The coupling (link) coil, L3, consists of 5 turns of No. 14 fiberglass-insulated copper wire wound over the center of L2. The variable capacitor, C2, is a two-section type removed from an old AM broadcast radio. If the rf power to the antenna is over 100 Watts, use a capacitor with double-spaced plates. The common rotor terminal of C2 is connected to the aluminum case of the toroidal balun and the outside (shield) conductor of the 52-Ohm line.

The matching adjustments are the same as described above except that it may be necessary to adjust the number of turns in the coupling coil, L3. At W6TYH, we started out using three turns in L3 but found that five turns were required to produce proper loading at the transmitter with a 1:1 swr on the 52-Ohm line.

Antenna Supports

Our station, W6TYH, is located on a ranch in the foothills of the Sierras in Placer County, California, and the site is surrounded by many trees. The ham who uses trees to support his wire antenna systems must use ingenuity to keep them up during stormy or unusually windy weather. Fig. 7 shows how this problem was solved at W6TYH. Fortunately, we have two large oak trees about 85 feet apart, just about the right distance to support the center section of the array in the clear. Each tree has a large limb about 35 feet above the ground.

As shown in (a), a hook and pulley assembly is made up from a bicycle-storage hook and a small metal pulley to pass a 1/4-inch nylon rope. The hooks can be obtained at most bicycle shops or hardware stores. They come in pairs and are designed to screw into a garage wall or ceiling for hanging a bicycle or other objects. The pulley is securely fastened to the threaded end of the hook. The support rope should be 1/4-inch nylon rope and must run freely in the pulley without binding. I made the mistake of using a rope with a diameter too small for the pulley. It was necessary to lower the antenna with a dozen blasts from a 12-gauge shotgun (much to the annoyance of the XYL and the neighbors) after the rope stuck in the pulley.

After the antenna is pulled up to the desired height, a pair of five-gallon plastic pails are attached to the lower ends of the rope at each end of the array. Drill several 1/2-inch holes in the bottom of each pail to allow accumulated water to drain out. Fill each pail with just enough gravel so that the weight will keep the array in place but will allow the pails to move up and down during severe wind storms. I had just returned home from the hospital, about two years ago, when we had a severe storm with 75-mph winds. Several verticals and one three-element beam bit the dust (mud) but the 20-meter collinear remained in place. For two days I lay in bed, hooked up to an oxygen tank, and watched the plastic pails go up and down like elevators in a skyscraper. But the antenna stayed up.

The best performance will be obtained, of course, if all of the radiator sections are stretched out in a straight line as high above ground as possible. At W6TYH, because of interfering tree branches, the end sections slope toward the ground. The array appears to have a gain of about 5 or 6 dB in each direction in spite of the fact that the installation is not perfect. Because of the proximity of the ground to the ends of the radiators, it was necessary to adjust the length of each end section about 6 inches longer. We had expected that each section would require shortening. The sketch in Fig. 7(b) shows how the conductor length is adjusted.

I would be interested in hearing from readers who build this array. All letters will be answered if a stamped, self-addressed envelope is enclosed. ■

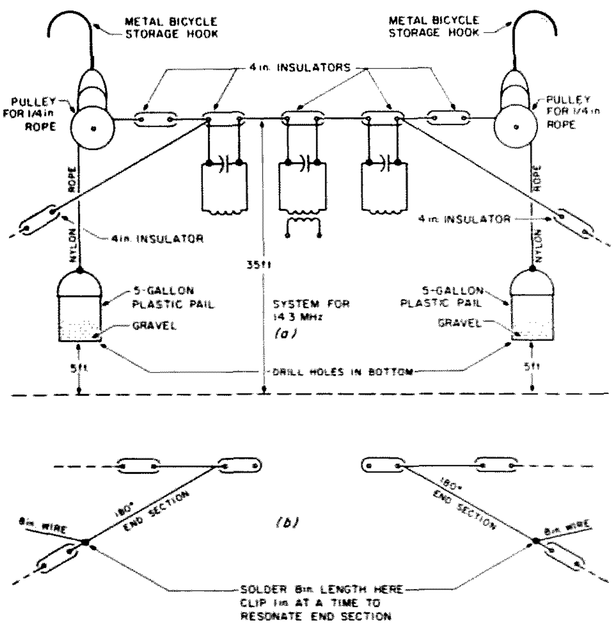


Fig. 7.

Leon Fletcher N6HYK
274 Webster Drive
Ben Lomond CA 95005

Good to the Last Dot

Is there life beyond WX HR IS? With these practical tips you'll perk up every QSO and make every contact an adventure!

A surprising number of readers of *73* responded to the invitation, published in the September, 1983, issue, to "send me the tips you've discovered, the techniques you use to improve your on-the-air skills."

That invitation accompanied my article "How to Increase Your QSOs" which presented eleven "practical, QSO-tested techniques—specific information every Novice needs immediately after he or she has passed the FCC tests: tips and techniques about actual on-the-air operation."

Not only beginners can benefit from tips, however. As the article noted, many General-class operators, and even a good many Advanceds and Extras, make basic operating goofs. One reason may be the lack of such tips in standard operating manuals, handouts, instructional guides, and such material.

My tips came from two sources. Most came the hard way—from my own on-the-air experiences. The rest came from a poll I conducted of the 96-member US Naval Postgraduate School Amateur Radio Club in Monterey, California.

That article did not present techniques which are unusual or sophisticated. Rather, it detailed these quite basic techniques, most of which are usually unpublished or ignored:

- Using headphones
- Listening around the "Big Guns"
- Listening at a "hangout"
- Listening where there's no action
- Sending at a speed a bit beyond your skill
- Slowing your CW speed when you start fumbling
- Making your on-the-air time important to you
- Ignoring stations which "don't sound right"
- Knowing how to tune up
- Checking the action on other bands regularly
- Learning to live with QRM and QRN

A few days after the article was published, letters started arriving at my shack as hams across the country sent me additional techniques they find valuable. Here are the best of their suggestions.

KD3S

"I call this tip the negative CQ," wrote James F. Reid KD3S, of Laurel, Maryland. "I discovered it rather by accident. I had been calling CQ until I thought my arm would drop off and was getting no answer. I said to heck with it and tuned the rig to a quiet spot and sat back to read a magazine. Within five minutes somebody started calling CQ on my frequency. I called him back for a nice QSO. Since then I've had success with this trick several times. Just tune the rig to a quiet spot and wait. The QSOs will come to you."

K8GPT

Norm Hediger K8GPT, who operates from Dearborn, Michigan, sent some suggestions for the next step in QSOing. He wrote, "Along with making the contact is the problem of what to do *during* the contact." His tips include, and I quote:

1. When you operate, be alert and attentive to what you are doing and hearing. Sit in a comfortable position. Don't slouch—it's too easy to doze off or let your mind wander.

2. For making notes or copying, use a good pen or pencil—one that you are familiar with and which is comfortable to you. Don't try to get by with that old chewed-up stub that once was a pencil.

3. Use a decent size piece of paper for your notes—not just any scrap you can find. The reverse side of your log sheet makes a handy place to write notes. A clipboard or pad sometimes helps.

4. When copying, try writing everything in small letters. Printing and capital letters sometimes take more time and slow down your

speed. Also, don't try to write on your knee; use your operating desk or tabletop—something solid.

K1PLR/3

The importance of listening was emphasized in a letter sent by H. A. Arsenault K1PLR/3 of Erie, Pennsylvania. "I try to spend at least 15 minutes getting 'the lay of the land'"—listening up and down a band before going on the air. "You make no friends by loading up, tuning, and going on a blind frequency."

He also stressed the value of studying propagation predictions. "Be able to predict or understand what bands are open and when. It is most discouraging to put up a nifty antenna and call CQ on 10 meters until I turn blue in the face with no response, only to find out that my efforts coincide with the biggest solar flare in history."

Finally, K1PLR/3 pointed up the importance of brevity and of skill in using your equipment. "No one likes to contact someone who, with the aid of a keyer, takes ten minutes to send his name."

KA8DKT

Tuning techniques were detailed by Gary Sharpe KA8DKT of Toledo, Ohio. He wrote that while a ham sometimes needs to tune up on the air, "It seems most hams believe that you must tune up on exactly the frequency you are going to operate. For example, listen to any DX station—CW or SSB—and [you'll hear many] carriers [tuning up] during the contacts."

Gary then pointed out, "There is no commercially-made transmitter which tunes so sharply that an operator couldn't move as much as 30 kHz up or down the band to a clear spot to tune up."

He added, "My technique is to select a General-band area that I wish to operate in—usually 40–100 kHz wide. I then tune the transmitter up at the approximate middle of this band area, taking care not to interfere with any QSOs in progress.

"Now I am free to work stations or call CQ in a 100-kHz range without touching any controls on the transmitter except the vfo. Most transmitters and transceivers will operate at least ±40 kHz from the tune-up point quite satisfactorily. And even if the power output drops a few percent at the extreme ends of the bandwidth, a ham should know that it takes almost a 30% decrease in output power to make a noticeable difference at the receiving end—even in a pileup."

W9ALM

Six suggestions were sent in by William C. Caldwell W9ALM, of Kokomo, Indiana. Bill holds an Extra-class license and has been hamming for 46 years ("since I was 13—same call letters"). He works "mostly CW—99% since getting on the air." His advice is:

1. Listen before transmitting—learn how to use QRL? (Is the frequency busy?) This is very important because you may not be able to hear a station who is too close due to skip or band conditions.

2. Learn the "BK" QSO system. BK means "break-in"—not just "back to you." Since you need to send your callsign only every ten minutes, you can get a lot more information by not signing your call every time. Just send "BK" at the end of your message and the other station starts transmitting—if he knows the BK system.

3. Learn to combat QRM/QRN. If your rig has internal filters, use them. If not, try an external filter. Also learn how to ask for a QSY (a request to change frequency).

4. Use a tape recorder. Record QSOs to help improve your sending. This is the best way to learn how you sound at the other end. Simply put the microphone of the recorder near your speaker.

5. If you have more than one antenna for a given band, use a multiple-antenna switch. The antenna which gives the best reception will usually give the best transmitted signal.

6. Make schedules with hams you like to QSO. Real friendships can develop. Visit them when traveling near their QTH.

WØVS

Another ham who "operates almost exclusively CW" sent a good tip from Sierra Vista, Arizona. Jim Droege WØVS, wrote: "People who habitually run high speed—25+ wpm—can have a lot of trouble at slower speeds." The solution: Make a regular routine of sending at different speeds. Jim adds, "Variety [in your speed of sending CW] also seems to improve your accuracy."

Jim also added another advantage to using headphones, besides the benefits named in my September, 1983, article: Good phones increase the volume, focus your attention, sharpen your listening, reduce other sounds, and improve your operating. Jim's perceptive addition: "Phones also make my wife happy!"

W2HAE

Arthur C. Ford W2HAE, of Melbourne, Florida, submitted these tips:

1. The newcomer must be acquainted with his equipment—what it can or cannot do. The current transceivers are gems in flexibility if owners will take the time to read the manuals and experiment.

2. If the swr is poor, find out why and adjust the antenna for maximum efficiency or generally minimum swr.

3. Another overlooked item is the position of the antenna-loading switch. One position will give you the best match or efficiency.

4. Avoid CQing on top of a foreign broadcast carrier.

5. Pick an open spot as clean of QRM as you can find. Don't fight the heavy concentration [of stations, QRM, or QRN] in one band spot. Spread out. If 80 meters is QRN-plagued, shift to a higher band. And do not ignore 10 meters in the evening; look there for a nice solid QRM-free QSO.

6. Learn—by listening to other operators who are more experienced.

7. Avoid punctuation. The common "BT" should suffice on most occasions to separate thoughts or sentences.

8. Unnecessary QSZ (sending each word or group more than once) serves no purpose if you are sending at the proper speed to the other fellow.

9. Practice sending CW into a tape recorder, and copy your own sending for punishment.

10. After sending a CQ, rock the RIT control and sometimes you'll find someone calling you just enough off your frequency [so that you might not have heard him or her if you left your rig at the exact frequency on which you called].

Do such tips seem too basic for you? Then check again the second and third paragraphs of this article! These *are* intended to be tips Novices need as they first begin to operate. But don't be too cocky—many Advanceds and Extras also can be heard making basic operating goofs! ■

Do you have still more tips for increasing your QSOs—techniques which were not included either here or in my September, 1983, article? Please send them to me, so that we may publish another roundup of ideas. Include your call, name, and QTH so that you may be credited for your suggestions.

Porcupine Mobile

Bristling to work HF from your car? Sport these spikes and hit the road.

Glen Russell N2CMU
915 Academy Street
Watertown NY 13601

This antenna should be of interest to mobile hams as well as indoor antenna users. It will let you go HF mobile without a whip.

The project started when I was trying to use a Hustler mobile whip-type antenna that uses three resonators. After having problems with mounting brackets and finding the whip to be a little too top-heavy, I decided to eliminate the 5-1/2-foot whip altogether. It's true that guy strings could have been used, but that would have made a rather unsightly lash-up.

Instead, I took an old Hustler 80-meter resonator and unwound its coil. I then used the coil as a mounting fixture for my HF rooftop antenna. I found a strong magnet-mount base (off of a CB antenna). The 80-meter resonator thread size is 3/4" #24 and the magnet mount was already countersunk, so it was a simple matter of using a 3/4" #24 nut to fasten the modified resonator to the magnet securely. The magnet must be strong enough to hold firmly onto the roof of the car at 60–65 mph.

Next, I drilled and tapped the top of the resonator to fit a 1/4" #20 bolt. I took the Hustler 3-resonator adapter plate and enlarged the center hole so it would fit snugly over the resonator. I fastened it in place with a 1/4" #20 bolt and lock washer. You now have a fixture for a roof-mounted, 3-resonator HF antenna.

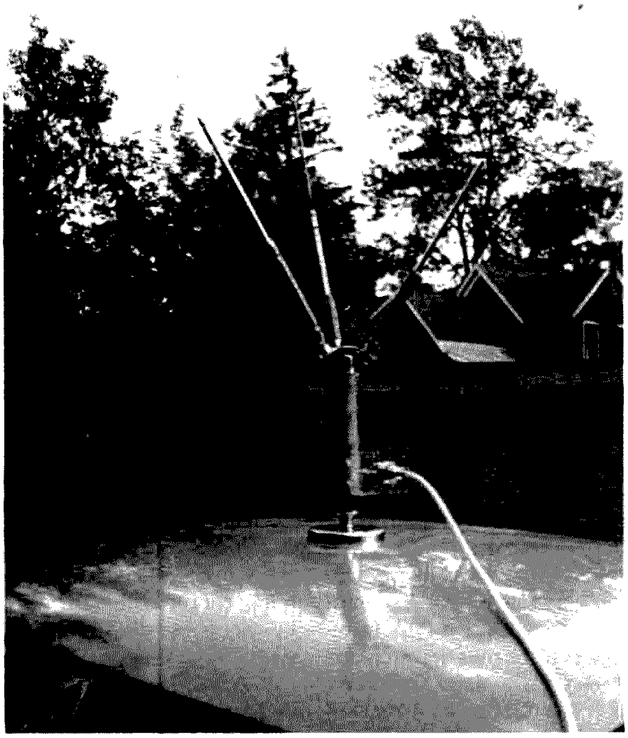
I made a plastic-type plate, mounted a female coax connector (see photo), and drilled a couple of small holes through the resonator for mounting the plate. Note the three turns of #10 copper wire on the resonator. This serves only to connect the center conductor of the coax fitting to the resonator plate. A straight wire could have been used, but I thought it would look much better with three turns (and it does).

Don't forget to connect the ground lug of the coax connector to the base of the mount. When all three resonators were in place and everything was properly tightened, I sprayed the entire antenna with three coats of clear Rustoleum metal protector. This prevents weather damage.

The height of the antenna from the rooftop to the 20-meter resonator tip is 32" (total height). The distance from the base to the top of the adapter plate is only 9-1/2".

Now for the on-the-air test. I was unable to adjust the resonators enough to get the swr lower than 2.8:1. This was no good! It was no doubt due to the close proximity of the resonators to the car roof. I still had no doubts that it could be made to work, so I bought a MFJ 940-B Versa Tuner. This solved the problem.

On any frequency within the 10-, 15-, and 20-meter bands, the tuner will bring the swr down to 1.1:1. The in-line wattmeter shows full output—100 Watts on 20, 90 Watts on 15, and 80 Watts on 10. (I'm using an FT-77 mobile rig.)



This HF mobile antenna is ready to roll.

On-the-air performance has been very good. I think it is better than when I was using the whip. I believe this may be due to the tuner, which allows much sharper tuning of the antenna at a given frequency. When using the whip setup, if you vary the frequency more than 50 kHz, the swr changes rapidly and it is necessary to readjust the resonator—which is not always easy to do. With or without a whip, I highly recommend an antenna tuner!

There is no doubt that the radiation pattern is much different than that of a whip, but it seems to be a favorable difference. My signal reports have been excellent. All I can say is that it works, and I don't have to worry about the 5-foot whip and the mounting brackets. This antenna would also make a great indoor tabletop antenna when used with a tuner. 73.■

Eugene Dusina W4NVK
4724 Ridge Grove Road
Knoxville TN 37918

The Rubber Duck Debunked

In ten minutes you can have 10 dB gain over your HT's duckie. It's enough to make you try.

Sometimes with only an HT and a rubber ducky available, hams find that they can't quite bring up a much needed patch. A temporary way to boost power would be very useful. This article describes a simple antenna attachment which will boost power about 10 dB. It does not interfere with the portability of the radio.

How Bad Is It?

The typical ducky antenna used on hand-held radios has a large loss compared to a simple dipole. At 2 meters, for example, using a pull-out whip dipole from a portable TV, with each whip pulled out to 19.5" in length, fed with about 3 inches of 50-Ohm coax, and held vertically against the radio's side, 11.5-dB gain over the ducky was measured on a commercial field-strength instrument. The typical small TV dipole folds into a U shape about 1.5" x 10", and pulls out any distance up to 60". Although quite a good antenna, it is a bit clumsy to use.

A Better Way to Go

I settled for a less perfect simulated dipole which measured 9.5 dB better than the ducky. To make it, I used a regular BNC-fitted upper whip of 23" in length, replacing the ducky. A similar upside-down antenna, pulled out to 21" in length, made a lower dipole element. Its upper large end is grounded to either the radio chassis or the shell of the BNC connector on the radio. The lower whip is shorter to compensate for the effect of the chassis.

Both whips can store on the radio's side by making a holster of 1" pieces of flexible plastic tubing into which the collapsed antennas slip. Cement the tubing to the radio's plastic case with instant glue. (Put the tubing on the side that will allow the battery to slide off if the collapsed antennas extend down that far.) The lower whip can be permanently attached to the radio so that it quickly pulls down when needed, and is out of the way when not in use.

Table 1 shows measured gains of antennas adjusted in length for the best field of radiation at 0° elevation angle. Variation in the length of the elements by an inch or two caused small variations in radiated field, which would be masked in practical use by much larger variations due to the holding position of the radio. Those variations are due to detuning and absorption effects of the body of the user, and are the price paid for extra small size and close holding.

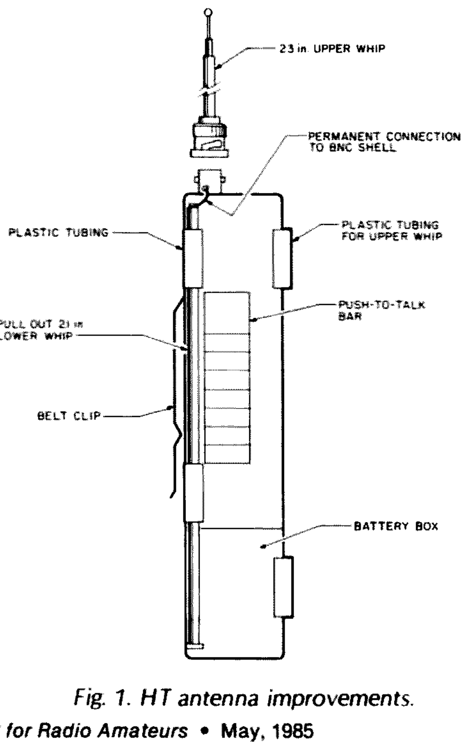


Fig. 1. HT antenna improvements.

Duck antenna	= 0 dB reference
20"	= +7.5 dB better than duck
21" x 23" whips	= +9.5 dB better than duck
39" TV dipole	= +11.5 dB better than duck

Table 1. Experimental comparison on an ICOM 2AT at 146 MHz.

Unusual care getting precise lengths, good match, etc., is wasted effort. Almost any elements about the length mentioned cause a large increase in radiation, and the extra which could be gotten with precision will vanish at a slightly different hold of the radio.

Hand-held radios are designed to tolerate large swr ratios without damage, for they get these routinely as the unit is moved about in the hand when transmitting. The wise ham needing more power will get extra output by an antenna efficiency boost. The novice will strain his finals and reduce vswr immunity by using an overvoltage battery, to boost rf power.

Make-Do Is Good Enough

I suggest the practical ham use whatever whip he has, and if it pulls out too long, solder the extra end sections to the top bead so that it pulls out to the length he finds best. That will be good enough. We

are after better practical performance, not a standard reference antenna.

The tinkerer can use a simple field-strength meter at close range to find the best lengths for his radio. The dimensions are not very critical, but he may want to prove to himself that he has gotten close to the best possible.

Fig. 1 shows how I arranged an ICOM 2AT antenna. Both whips store on the side when the ducky antenna is being used.

All other hand-held radios which use whips working against the radio as a ground plane suffer similar loss and should experience similar improvement. The improvement is small above 1000 MHz, modest at 420, sizable at 220, large at 144, and enormous at 6 and 10 meters. This is directly related to how much smaller than a quarter wavelength the usual hand-held chassis is. Apparently, the added ground plane from the hand and body is canceled by the losses in the skin to the rf coupled from the chassis.

I suggest manufacturers build into hand-held radios a small-diameter collapsible whip pointed downward which would temporarily boost erp by a large amount for those difficult propagation conditions. Such an innovation would greatly increase the utility of hand units.

I personally used the concept of an extra, built-in, upside-down whip on the first CB hand-held radios in the 1950s. They desperately needed more ground plane, and the effect was quite impressive. Since the concept was not patented and some were sold, the idea is now presumed to be in the public domain, by my understanding of patent law. Therefore, commercial addition of this feature would be very inexpensive and greatly increase sales appeal. ■

Jonathan L. Mayo KR3T
125 Wilton Woods Lane
Media PA 19063

The No-Baloney Lunchbox

We suggest you paint this antenna tuner before showing it to your friends.

One of the most useful and easily-built projects for the ham shack is the antenna tuner. An antenna tuner, or transmatch, is a device used to couple a transmission line to a transmitter, providing an artificial match between the antenna and the transmitter when the swr would otherwise be too high for proper operation. It does not actually correct the antenna mismatch, but "tricks" the transmitter into thinking the antenna is matched and therefore lowers the swr at the transmitter to an acceptable level. The capabilities of an antenna tuner can be handy in a variety of operating situations. Let's discuss antenna tuners in general before going into details about my "lunchbox" design.

One of the most common applications for the antenna tuner is combining it with a longwire antenna of random length, or other radiating devices such as window screens or bed frames, and tuning the antenna for each band as required. If the longwire antenna is not part of your present antenna system, there is still a definite need for an antenna tuner. If CW is your game, your antennas are probably optimized for the CW portion of the band, and vice versa for phone. Moving from the CW portion of the band to the phone portion can result in unacceptable swr readings, especially if your antennas are not particularly broadbanded and you are using a solid-state rig. This is where an antenna tuner can come in handy.

The unacceptable swr can be reduced to an acceptable level by inserting an antenna tuner in the transmission line along with an swr meter and adjusting it for the lowest swr. In most cases the line loss is negligible and the benefits far outweigh any trouble it might be to implement it into your system. Also, many solid-state transmitters have a built-in swr protection circuit that decreases power when the swr increases to unacceptable levels. Therefore, a low swr ensures full power to the antenna or amplifier. Antenna tuners also tend to attenuate harmonics from the transmitter; the amount depends on the design of the unit. A good antenna tuner can help reduce TVI considerably.

There are many different designs for antenna tuners, some more complicated than others. Among the different designs are the pi network, the T network, and the L network. They all use the same basic parts, but each has them arranged differently.

Different Designs

As seen in Figs. 1, 2, and 3, the main components of every design are the capacitor and the inductor. Each design differs not only in physical appearance but also in electrical characteristics. Let's take a look at each design and find what each has to offer.

First, let's look at the L-network antenna tuner (Fig. 1). It is known as a simple solution to what can be a big problem. It is a simple design that should be considered when contemplating an easy-to-build antenna tuner. It is ideal for coaxial-fed dipoles and longwire antennas. While usually it is thought of as a single-band tuner, the addition of taps to the coil and a variable capacitor provide much flexibility. The capacitor must always face the greater impedance, and a switch can be added to alternate the positions of R-in and R-out depending on the an-

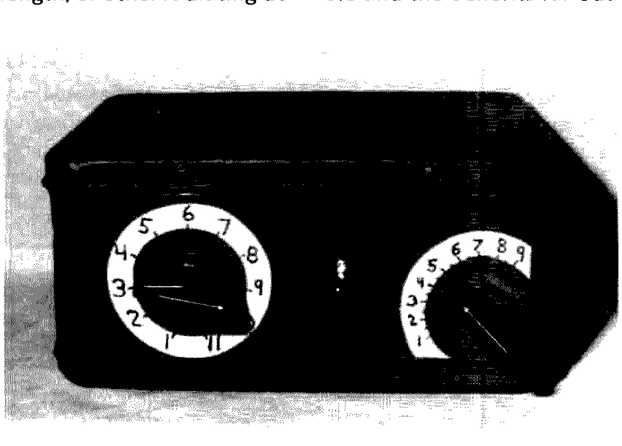


Photo A. Front panel of the lunchbox antenna tuner. Controls, from left to right, are: inductor taps, R-in/R-out switch, and variable capacitor.

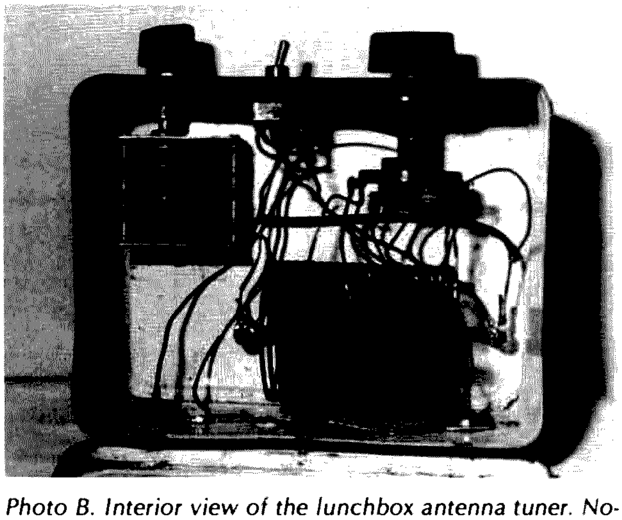


Photo B. Interior view of the lunchbox antenna tuner. Notice the arrangement of the parts in this L-network tuner.

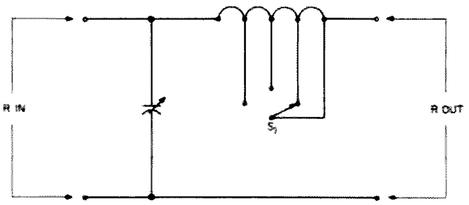


Fig. 1. An L network with variable coil taps (S_1). The capacitor should always be on the side of greater impedance (R in > R out.)

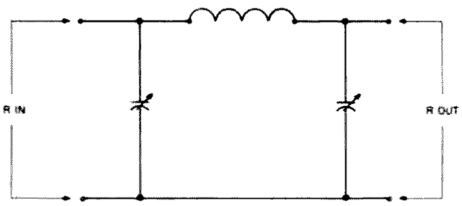


Fig. 2. A pi network which provides more flexibility than the L network. Notice the use of dual capacitors.

tenna characteristics. The L network is an excellent simple antenna tuner with a lot of potential.

The pi network (Fig. 2) is similar in design to the famous tuned circuit studied by so many for their ham license. Its design is also fairly simple, and the additional capacitor enables it to handle incredible mismatches with ease. This network provides more flexibility than the L network by eliminating the need for an R-in/R-out switch and giving better control over circuit Q.

The T network (Fig. 3) uses two capacitors and an inductor as in the pi network, but has them arranged differently. The T network is known for its sometimes poor harmonic attenuation. It becomes, in effect, a high-pass filter. If you use a T network, be sure to use it in line with a low-pass filter. However, another type of tuner, the SPC (Series Parallel Capacitance) transmatch, takes off from the T network and eliminates its poor harmonic attenuation. This "Ultimate Transmatch" is shown on page 19-11 of the 1981 edition of *The Radio Amateur's Handbook*.

Depending upon the situation, one antenna tuner design might be preferred over another. If a broad range of antennas and frequencies is to be used with the tuner and the antennas are nowhere near resonance, one of the more complicated designs may be required to correct the mismatch. Some antenna tuners are designed to feed balanced lines, and these often incorporate a balun in their design. If the antenna is fed with a balanced line, a balanced output from the tuner is a necessity. The design which was chosen for my multiple coaxial-fed dipoles was the simple L network, packaged somewhat differently.

As mentioned before, the main components of any antenna tuner are the inductors and capacitors. They are connected in some way, depending on the design, so that they form a tuned circuit which compensates for the mismatch between the transmitter output and the antenna system. The values of the inductance and capacitance required depend on the frequency and the nature of the antenna mismatch.

If you want to be exact, you can use a noise bridge or similar device to measure the input impedance of the antenna system at a given frequency. Then substitute the measured impedance and corresponding frequency in the Fig. 4 equations. The solutions to the equations will give the values the capacitor and inductor must have to give a proper match. A single-frequency device can use fixed values for the inductor and capacitor. However, for multi-frequency operation, do measurements and calculations for all frequencies the antenna will be used on and pick the highest component values of all the calculations. In most cases, a 365-pF capacitor and a multiple-turn (8 to 10 turns, 1½-inch diameter) inductor from the junk box will do just fine.

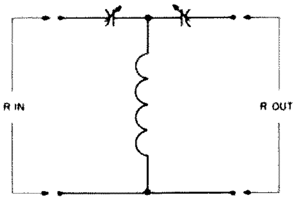


Fig. 3. The T network is known for its poor harmonic attenuation. It sometimes becomes a high-pass filter.

The L network provides excellent matching with a minimum of construction and design. Mine was designed for use with unbalanced lines only and does not contain a balun. Its design is simple and efficient, and I further simplified design considerations by paralleling the two 365-pF sections of a "broadcast" capacitor, using a 10-position switch for the inductor taps, and building it in a child's metal lunchbox.

Construction Ideas

All of the parts used in the construction of this L-network antenna tuner can be obtained quite inexpensively at local hamfests—and may be in your junk box. Two switches are needed, one multiple-pole rotary switch (at least one pole per band) and one ordinary DPDT switch. Some wire, two SO-239 coax connectors, and two pointer knobs make up the rest of the needed parts except for the most important two: the inductor and capacitor.

The next step in the construction process is obtaining the case so that each part can be placed for the best fit. A metal lunchbox with the handle and latch removed served as an ideal case for my tuner, being both convenient and cheap. (Portable and Field Day operators may choose to leave the handle on for easy transportation.) The hinged lid allows for easy access to the parts and a better case would be hard to find, regardless of cost. I added a few sheet-metal screws around the lid to improve the rf tightness of the box.

Once all the necessary parts are assembled, plan their arrangement in the case. Notice the arrangement of parts in the picture of the inside of my tuner (Photo B), and pay attention to the schematic (Fig. 6). Once you have a general idea of how all the parts will fit in the case, mark their locations, remove them, and prepare for mounting.

Drill the appropriate holes for the parts you have obtained and mount them. Make sure those parts which are to be grounded make good contact; scrape away

R in > R out	R out > R in
$X_L = \sqrt{(R\ out \times R\ in) - R\ out^2}$	$X_C = R\ out \times R\ in/(R\ out - R\ in)$
$X_C = (R\ out \times R\ in)/X_L$	$X_L = (R\ out \times R\ in)/X_C$

Fig. 4. The equations used for determining the needed inductance and capacitance for the tuner circuit as explained in the text. Use the proper equations as determined by the characteristics of your antenna system (i.e., if the antenna's impedance is greater than the output impedance of your transmitter, use the equations under R out > R in).

any paint or finish on the case. As a further precaution, I ran a separate ground wire to connect all circuit grounds. Wire the parts as indicated in the schematic, making any necessary adaptations that your particular design requires. Be sure that the coil and capacitor rotor do not touch the lid when the case is closed; I mounted my inductor on short standoffs. Decide if the wires from the rotary switch are to be soldered to the coil or if clips are to be used. Clips might be used during initial testing; the wires can be soldered to the coil after the ideal tapping positions for each band have been found.

To ensure that the capacitor is always to the high-impedance side, the DPDT switch has been incorporated in the design; it switches the input and output SO-239 connectors. You may leave the switch out if you are willing to reverse the input and output coax when needed. Once the parts are mounted and connected, the finishing work is ready to be done.

If your case's appearance was even close to that of mine, it will need to be painted. I used a flat grey spray paint which matches the color of my transceiver. Be sure to apply the paint in layers and be careful that it does not run and leave unseemly streaks on your case. For protection against scratches, rubber feet may be added.

After the paint has dried, labels need to be applied. They are necessary for fast retuning during band changes. Notice in the picture of the front panel that the knobs have numbered positions (Photo A). These homemade labels are easy to fabricate; take the appropriate measurements and cut the rings out of index cards or similar material. Temporarily place the rings over the knobs and mark the different switching positions. Then number the positions and glue the labels on with rubber cement. Make sure they are properly placed and easy to read: These labels are referred to often during the operation of the unit.

Operation

Now that the assembly is complete, the tuner is ready to be tested with your antenna system (see Fig. 5). Attach the coax from your antenna or antenna-switch box to one of the SO-239 connectors. Next, attach your swr meter to the other connector, using a short piece of coax if necessary. Finally, connect the swr meter to your transmitter.

Now the tuner is ready to be checked out under fire. At first it may seem difficult to use, and tuning the antenna can take a while. However, the more it is used, the easier it is to operate. Tune the transmitter to a vacant frequency where you plan to operate. Using the lowest power possible, key down the transmitter and quickly check the swr. Decrease the swr by tuning the capacitor and changing the taps on the inductor.

Do not keep the transmitter keyed down too long, and be sure to identify your station frequently. Continue to listen on the frequency to make sure it is clear; if it is not, tune slightly to a clear frequency. If the swr won't reduce to an acceptable level, switch the R-in and R-out and tune again. The swr normally can be reduced to roughly 1 to 1 in a matter of seconds. Record the final knob and switch settings.

I keep a note card with a table of CW- and phone-band settings for all frequencies of interest for each antenna. This way, whenever I want to operate on a certain frequency, I look it up on the card for the antenna I am using and set the tuner knobs and switch to the settings indicated on the card. Then I am instantly ready to operate on that frequency with an swr close to unity without any additional tuning. Soon you will begin to wonder how you operated without it.

Conclusion

For the multimode, multiband operator, an antenna tuner is almost a required station accessory, especially for those using solid-state rigs. However, building antennas carelessly and making up for it with an antenna tuner is not good practice. You can have a 1 to 1 swr into your transmitter and still have lots of losses in your antenna system. Watch out for feedline and ground losses. Fortunately, coaxial-fed dipoles can be operated in the HF bands at a fairly high swr with low losses.

Building antenna tuners can be a never-ending practice. They are so useful and serve such a vital function that it is difficult to get along without one. Usually, once one design is completed you'll want to try to build a "new and improved" version.

There are several useful accessories that can be incorporated into an antenna tuner. A built-in swr/wattmeter would eliminate the outboard swr meter. Also, a multiple-antenna switch could be added, possibly connected to a remote-relay antenna-switching system. A built-in 50-Ohm noise bridge can eliminate the need for on-the-air tuning. New experimental designs can always be fabricated with the parts already in use plus a few more. There is always room for upgrading.

The knowledge gained in building this simple lunchbox antenna tuner can be applied to all others, no matter how complicated. Antenna tuners are great fun to design, build, and use. They are simple to construct and make a great first project for the Novice. Tuners are always useful to have around.

Enjoy the freedom to roam around the bands using your antenna tuner. Read more about them in the books listed in the references and look over the different designs. I hope you have as much fun with your tuner as I have had with my lunchbox design. Never again let a high swr keep you from operating where you want. Good luck and happy hamming. ■

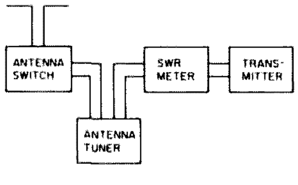


Fig. 5. The antenna tuner shown installed along with other station equipment.

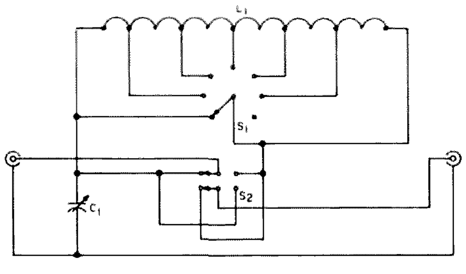


Fig. 6. Schematic of lunchbox L-network antenna tuner described in the text. L_1—multi-tapped inductor, C_1—variable capacitor, S_1—multiple-pole rotatable switch, S_2—DPDT switch.

References

***The Radio Amateur's Handbook*, 58th edition (1981), ARRL Publication, pages 19-10 to 19-14.**

***The ARRL Antenna Book*, 14th edition (1983), ARRL Publication, chapter 4.**

***Radio Handbook*, 21st edition, William Orr W6SAI, chapter 26.**

Rotate the Bobtail Curtain

How do you rotate one hundred feet of wire antenna? It's simple: Just flip the switch.

Jerrold A. Swank W8HXR
657 Willabar Drive
Washington Court House
Ohio 43160

Back in 1980 I wrote an article for *73* about the "Bobtailed Bobtail Curtain," using only two elements of the array.* It is worth noting that since then I have discovered that the inventor of the Bobtail had originally used only two elements, but when no one paid any attention to it, he added a third element to make it seem more interesting, and immediately it became more popular. The extra element does not add a great deal to the effectiveness of the array and the extra space it requires is not worth the extra results if you are short of space.

For some years I have used the antenna firing N/S to work Antarctica. I have made over 10,000 contacts there and have spent more than 25,000 hours running phone patches for the folks there. I can get a 5/9 report barefoot and break into a pileup anytime. Now, however, I have discontinued this operation after fifteen years and would like to use my Bobtail to fire E/W to work a couple of friends in Arizona and New Mexico.

I cannot rearrange the array to fire broadside E/W both because of space limitations and because I would have to fire through the house next door. I have used the array on ten meters for E/W endfire and also knew that I could do the same on 20 meters by increasing the spacing from half wave to full wave. In my 1980 article I mentioned this, but also said that it could not be rotated easily by any simple method. Now I have thought of a way to do it.

At first I thought it would be necessary to make two separate antennas, each with a voltage-feed unit of coil and capacitor, and put a quarter-wave delay between them. I could then fire E/W but could not easily switch from broadside N/S to E/W. Now, however, I realize that while I cannot change the actual spacing, I could change the delay electrically so that I would have an endfire pattern, from pattern #1 (Fig. 1, left) to pattern #2, (Fig. 1, center) very easily and instantly. The drawings will show how this is done. In the original way of increasing the physical spacing, I would get pattern #3 (Fig. 1, right), as I had done before. This was not what I really wanted.

The horizontal wire runs through some tree branches, so I used insulated wire. No problem was encountered. The ladder line or other spaced pair of wires will be suspended horizontally so that the end and switch B come just outside my radio-room window where I can easily reach it. Or, the addition of a half-wave multiple of line at B will make it possible to move the switch to anywhere you want it.

*"The 20-Meter Double Bobtail," May, 1980, p. 44.

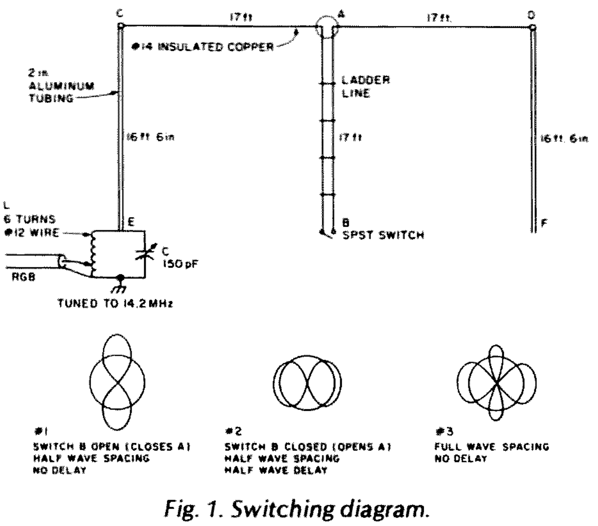


Fig. 1. Switching diagram.

When switch B is closed it will cause an electrical delay of a half wave, since A is open. The half wave is from A to B and back to A. The pattern is #2—endfire.

When B is open it presents a short to position A, as is the rule with quarter-wave lines. This makes pattern #1 half-wave spacing with no delay and is a broadside pattern N/S. If desired, the quarter-wave line can be dropped straight down to a stake or pulled off to one side where switch B can be mounted on a fence or tree.

A, E, and F are high-voltage points. B, C, and D are high-current points. The insulation requirements at B are very low, but the supports at E and F must be insulated well. The insulator at A must be a good one with adequate insulation and separation.

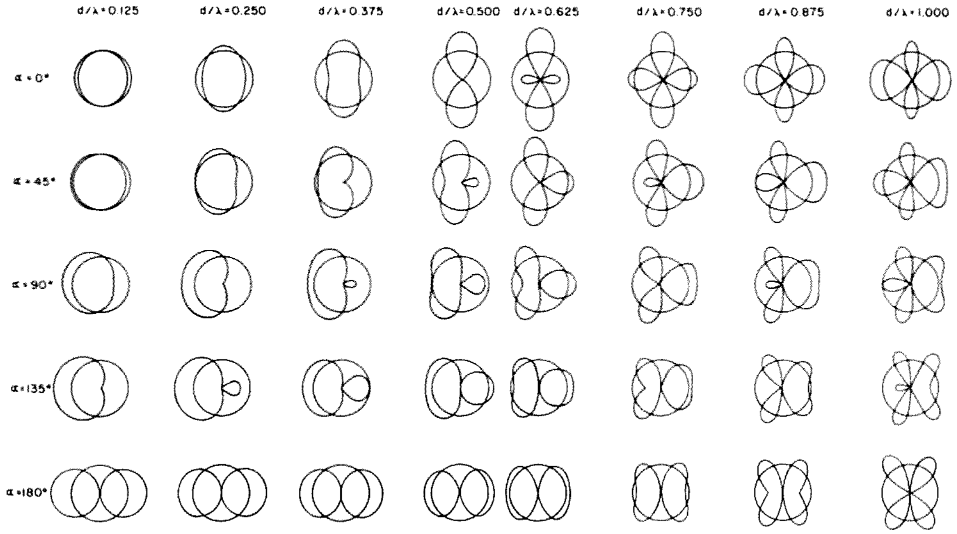


Fig. 2. Horizontal radiation patterns for an array of two antennas fed with equal magnitude currents.

The dimensions given are for 14.2 MHz. The length of the verticals is 234/f, and the antenna separation is calculated as 246/f, where f is the frequency in MHz. The first is the antenna figure and the second is the free-space figure.

Tuning is the same as described in the original article in *73*, or as the Bobtail is normally tuned. Adjust L and C and the tap on the RG-8 for lowest swr. Tune for the center of the band, as it is not critical. Switching will not require a change in tuning. ■

This is the final antenna article—of many written for *73*—by W8HXR, who died November 25, 1984. A ham for 65 years, he authored *The Magic of Ham Radio* (a *73* publication, 1980), a non-technical book to guide the beginner as well as to reminisce with old-timers.

Cliff N. Francis W0MBP
325 S. 3rd Street
Silsbee TX 77656

Alligatored Antennas

(clip) It's 30m . . . (clip) it's 17m . . . (clip) it's 12m. Get the idea?

The alligator clip is a marvelous invention. With a little imagination, you can add to or reconfigure your present antennas to achieve results beyond your present capabilities.

For instance, do you cry in your beer because your present yagi beam won't work 10, 18, or 24 MHz? No problem! To each element of your yagi, add a wire drop-loop (with alligator clips) 2/3 λ long (plus 7.37%), with the clips attached (centered) over a 1/3-λ section of your yagi element. See Fig. 1.

You now have a sagging-delta antenna (useful only on calm days and unguyed or low-height guyed towers) if you cut each wire for its appropriate use as a reflector, driven element, or director. With ingenuity, you can even figure out how to stop the wire from flopping in the wind. Since the radiation resistance of a delta/quad is about 100 Ohms (depending on various factors), expect a slightly higher swr—yet a very effective antenna. See your radio handbook on quad dimensions.

Suppose you have one of those great Bobtailed Bi-directional Broadside Curtain (BBBC) antennas (Fig. 2) and you want to change the direction of your signal without moving the antenna. Simple! Just add λ/4 elements with an alligator clip on each side of the center radiator at a distance of λ/4 (see Fig. 3).

It is no longer a BBBC, and you might need to fine tune your antenna tuner, but your signal now goes in the direction of the "curtain-rod."

And don't forget the old-fashioned method of broadening the resonance of your simple dipole antenna by adding short pieces of wire with alligator clips (see Fig. 4).

Mobile-hams have long known of this technique on 75- and 40-meter mobile antennas because the high Q of these antennas often limited the bandwidth (see Fig. 5).

It is a little trickier to try this on yagi beams, but it can work for a slight broadening of useful bandwidth.

Take a good look at that alligator clip—and think about it. What can you do with one? ■

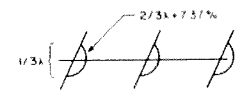


Fig. 1.

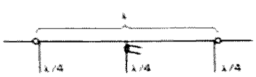


Fig. 2.

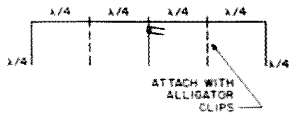


Fig. 3.

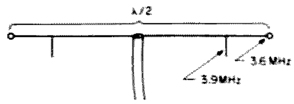


Fig. 4.

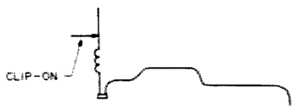


Fig. 5.

Zuper Zepp for VHF

Zip up your zignal with UZM's planz!

Wm. Bruce Cameron WA4UZM
324 S. Riverhills Drive
Temple Terrace FL 33617

Having tried a double-extended zepp on 450 MHz and approved of the results, I built one for 146. Even though I made the experimental model with number 14 wire, the bandwidth is good, but large-diameter tubing would be better. The wire suggests several methods of support. I used two pieces of 1" × 2" (screen stock) in the form of a T, braced by an 8" × 12" piece of plywood. The main section was nailed to the plywood, but the boom was bolted, for easier disassembly and transport.

The dimensions shown and measured in the graph make a good starting point. For frequency change, modify the radiating portion, and for match, massage the curved matching section. What you have is a 1.28-wavelength radiator fed with a continuously-varying tapered line. Probably the curve should be a hyperbola. This is a more forgiving match than the usual stubs. Gain should be 3 dB.

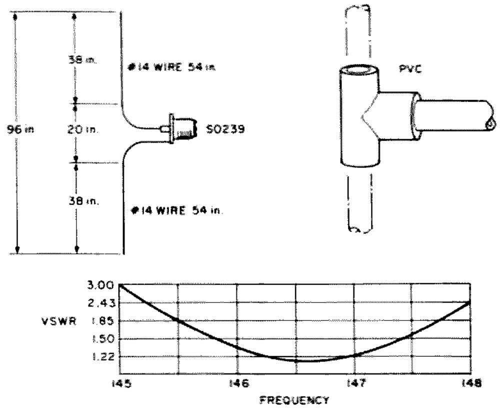


Fig. 1. Dimensions and details.

This antenna lends itself to a variety of mountings. You can side-mount it on a tower, stick it out a window, tape it up on a door or wall, hang it from a tree, or whatever. Since the high-voltage points are 20" apart at the closest, the insulation is no great problem. Dry wood will do. PVC pipe (with a large-to-small T fitting) would be better, and you could simply tape the wire to the tubing, facilitating adjustment. For a plumber's delight version, you might try EMT and borrow the electrician's bending jig. Dimensions will vary as you change the diameter of the material. ■

Paul H. Schwartz KB2XX
25 Dan Troy
Amherst NY 14221

Phase the Nation

North, south, east, or west, you'll be on target with the double-X trapped-vertical array.

After operating a multiband trapped vertical for eight years, I became interested in the subject of phased vertical arrays. There have been many articles about them over the years, but most referred to single-band systems.

Not wishing to give up multiband capability, I toyed with the idea of operating two trapped verticals in phase on 20 meters, and using one of the antennas for the other bands. Well, I decided to bite the bullet and try it out. Little did I expect the extraordinary results achieved!

As background, let me state that I have operated a Hustler 4BTV trapped vertical, ground-mounted with no radials, for eight years. This vertical works on ten through forty meters. I operate on the lower 25-kHz CW portion of 15, 20, and 40 meters, chasing DX with a barefoot HW-101, and have found that if I can hear them, I can work them. Thus, a trapped vertical has performed satisfactorily.

My plan was to ground-mount two Hustler 6BTV verticals to run in phase on 20 meters and operate the remaining bands on one of the antennas by means of a switch.

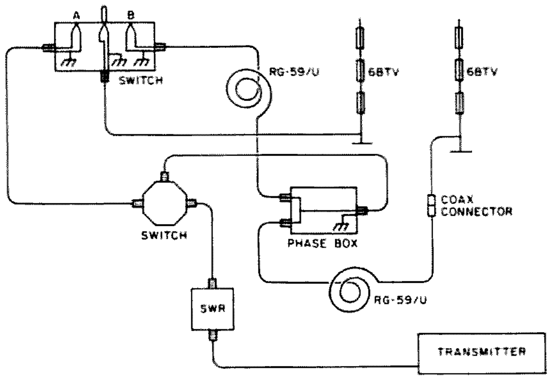


Fig. 1. Phased-vertical system diagram.

Theory

The theory of operating verticals in phase is quite simple, and the literature describes the effect of phasing clearly.[1] There are two main modes of operation; each has a figure-eight pattern of radiation and can be described as being either broadside or end-fire. By running the verticals in phase (0° phase shift), a broadside pattern is produced. Similarly, an end-fire pattern is achieved by feeding the verticals 180° out of phase. A simple phase change will effectively "swing" your signal to the desired direction.

I decided to erect the verticals in a north-south line and operate them in phase, producing a broadside pattern to the east and west. The antenna furthest from the house would be the one to run alone on bands other than twenty meters.

Construction

To obtain maximum directivity, the recommended spacing between the two antennas is one-half wavelength at the chosen operating frequency. The formula is: distance = (468 × vf)/f(MHz). Vf is the velocity factor of the coax, used when connecting the lines together and running a single line to the shack. This would only allow in-phase operation. In my setup, the verticals are phased with equal lengths of coax; therefore, I ignored the vf, and plugging in 14.0 MHz, the distance between the two verticals is 33.4 feet.

You will need to run equal lengths of coax from each antenna to the shack.

This requires some thought concerning how you will lay out and bury the feedline so as to account for the extra 33 feet of cable coming from the antenna nearest the house. I looped the near-antenna coax 15 feet towards the far antenna, then back again for 15 feet to take up roughly 30 feet. Two 125-foot sections of RG-8/U connect the antennas to the phasing system, which is located in the shack.

After tuning each vertical individually for the bands I was interested in, I built the 0° phase-shift box, shown in Fig. 1.[2] You could, of course, add 33 feet of coiled coax to one leg in the box to obtain an endfire pattern, but all of that cable would tend to be a little bulky.

Hustler states that the input impedance of the 6BTV is 52 Ohms, so it seemed that a direct connection in phase would be acceptable. However, things are never what they seem! After connecting the system, a terrible mismatch was observed. As was pointed out by W8HXR,[1] when the antennas are operated in parallel the impedance drops to 36 Ohms. Adding a quarter-wave transformer, made of RG-59/U, will improve the impedance match. The formula for the matching section is: length in feet = (246 × vf)/f(MHz), which, at 14.0 MHz, equals 13.2 feet.

Next, the switchbox was assembled (see Fig. 1). The switch is a 10-Amp, 125-volt DPDT type, which I purchased at Radio Shack (RS 275-1533). I enclosed the switch and coax connectors in a plastic box and used the inner conductor of some RG-58/U, stripped of the outer shield, for wiring the poles of the switch. The center connector of the switch runs directly to the far antenna. One side of the switch is connected to the RG-59/U which runs to the phase box, and the other side goes to the antenna switch using RG-58/U. Thus, by throwing a toggle switch, I can choose between phased- or single-vertical operation.

Upon testing, I found that not only was the swr below 1.5:1 on 20 meters, but also that the system worked on 15 and 40 meters as well. In other words, I could use the phased verticals on 15, 20, and 40 meters. The system functions with half-wave spacing on 20 meters, quarter-wave spacing on 40 meters, and three-quarter-wave spacing on 15 meters. Of course, the radiation patterns on 15 and 40 meters are different from the pattern predicted for 20 meters. Fig. 2 shows the theoretical plots.

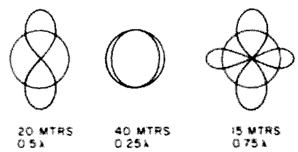


Fig. 2. Theoretical radiation patterns for three bands.

Conclusion

The final test was to operate the transceiver while prowling around the antenna site with a field-strength meter. Walking in a circle around the system, a figure-eight pattern was observed with major east-west lobes. The directivity was not as pronounced as the textbook's patterns but was certainly acceptable.

On the air, the results are gratifying. The broadside array snags DX regularly with 589 reports. For a high-performance antenna system that's easy to construct, you can't beat this phased-vertical array. ■

References

1. Jerrold Swank W8HXR, "Novice Guide to Phased Antennas," *73*, June and July, 1978.
2. Bill DesJardins W1ZY/LA0BP, "Phased Verticals for Easy DX," *73*, June, 1978.

Thomas M. Hart AD1B
32 Westwood Terrace
Westwood MA 02026

Where Am I Pointed?

Is this Sinclair beam-aimer program just like every other? Guess again.

It was *73* magazine that was responsible for developing my interest in 2m-FM operating through a large number of articles on that topic a few years ago. More recently, I started to read articles about home computers, and I must admit that I was very skeptical about the whole thing. My thinking changed as prices went down and as I did more reading on the topic, however, and when Clive Sinclair hit the market with the ZX-81 computer, I decided to make a move and invest.

Having the computer available, I looked into using it in various ham-radio applications. One obvious area was programming to compute the distance and direction to distant points—developing an antenna-aiming program.

The starting point was to survey the literature and determine what had been published on the subject. I found three valuable sources of data, a necessary step since my spherical trig is very rusty. The texts that I used are listed below.

The Earth can be considered to be a sphere with a 3960-mile radius. The prime meridian is a circle that passes through Greenwich, England, to establish an arbitrary zero longitude. East and west longitudes start from this point and go to 180 degrees in each direction. In this program, west longitude is shown as a positive figure and east longitude is shown as negative. The equator marks the zero latitude reference, and latitudes go north and south from this point to 90 degrees at the two poles. In this program, north latitude is positive while south latitude is negative.

The first and second reference books contain actual programs for use on certain computers. Both are more complex than that needed for the Sinclair. This is due to the fact that the ZX-81 has the arc cosine function built into the system. Many low cost personal computers lack this feature, resulting in the use of other conventions in programming.

The Carroll text provides the basic formulas used in solving the problem of determining distance and angle. The program presented here uses these for the analytical portion of the program. The calculations are given in the box.

The program itself is fairly

```
********************************
   ANTENNA AIMING PROGRAM
********************************

TO COMPUTE THE DISTANCE AND THE
ANGLE FROM WESTWOOD TO THE
TARGET, ENTER THE LATITUDE IN
DECIMAL DEGREES:

    LATITUDE:20

AND THE LONGITUDE IN DECIMAL
DEGREES:

LONGITUDE: 160
```

```
      ANTENNA AIMING PROGRAM

***** DISTANCE **** ANGLE ******
***** IN MILES ****       ******

********5237*********284********

5237 MILES ARE:

4550 NAUTICAL MILES


TO CONTINUE, ENTER Y/N
```

Sample runs.

simple. The following notes will clarify key points:

- Lines 5-88 set up the display and prompt input of the target location.
- Lines 90-180 perform the computations.
- Lines 183-265 control the display of the calculation.
- Line 45 should be changed to show your own QTH. The program listing shows Westwood, which is my QTH.
- Lines 100 and 105 should be changed to reflect the user's latitude and longitude.

Finally, be very careful to enter the program exactly as shown. The omission or addition of a parenthesis may cause problems with the output. Once loaded, the program can be tested before being placed in use. The ARRL *Antenna Handbook* for 1968 gives the following sample computation:

Location	Lat.	Long.
Chicago	41.9°	87.6°
Cairo	30.0°	−31.2°

Note that Cairo has an east longitude, a negative figure. The bearing from Chicago to Cairo is 49.3° with a distance of 6106 statute miles or 5306 nautical miles. To use these figures, substitute the Chicago data for LA1 and LO1 and enter the Cairo data as the target. The program will provide a good match to the *Handbook* result.

CALCULATIONS

C = (sin LA1*sin LA2) + [cos LA1*cos LA2*cos(LO2 − LO1)]
D = (60*arc cos C)
G = [sin LA2 − (sin LA1*cos D/60)]/sin (D/60)*cos LA1
H = arc cos G

LA1 and LA2 are local and target latitudes, LO1 and LO2 are local and target longitudes, C and G are intermediate computations, D is the distance in nautical miles, and H is the angle to the target.

The next item to consider is whether or not the angle determined for H is from 0 to 180 degrees or if it is between 180° and 360°. This is calculated by:

J = sin(LO2 − LO1)
If J ≥ 0 then let H = 360 − H

Once tested, the latitude and longitude for your QTH may be entered for LA1 and LO1. The program can be stored and loaded with the name ANTAIM.

Good luck with the program! I have found it to be very useful in itself and a good demonstration program for anyone who wants to know what the computer can do that is of practical value. ■

References

1. *80 Practical Time Saving Programs for the TRS-80*, C. J. Carroll, Tab Books, 1982.
2. *The Giant Book of Computer Software, 73 Magazine*, Tab Books, 1981.
3. *Plane and Spherical Trigonometry*, Nielsen and Vanlonkhuyzen, Barnes and Noble, 1968.

Program listing.

```
5 REM "ANTAIM"
10 PRINT
15 PRINT
20 PRINT "******************************"
25 PRINT " ANTENNA AIMING PROGRAM "
30 PRINT "******************************"
35 PRINT
40 PRINT "TO COMPUTE THE DISTANCE AND THE"
45 PRINT "ANGLE FROM WESTWOOD TO THE"
50 PRINT "TARGET, ENTER THE LATITUDE IN"
55 PRINT "DECIMAL DEGREES:"
60 INPUT LA2
63 PRINT
65 PRINT "   LATITUDE:";LA2
68 PRINT
70 PRINT "AND THE LONGITUDE IN DECIMAL"
75 PRINT "DEGREES:"
78 PRINT
80 INPUT LO2
85 PRINT " LONGITUDE:  ";LO2
88 PRINT
90 LET A=PI/180
95 LET B=1/A
100 LET LA1=42.23*A
105 LET LO1=71.23*A
110 LET LA2=LA2*A
115 LET LO2=LO2*A
120 LET C=(SIN LA1*SIN LA2)+(COS LA1*COS LA2*COS (LO2-LO1))
125 LET D=60*(ACS C*B)
130 LET E=D*1.151
135 LET F=(D/60)*A
140 LET G=((SIN LA2)-(SIN LA1*COS F))/(SIN F*COS LA1)
145 LET H=ACS G*B
150 LET J=SIN (LO2-LO1)*A
155 IF J>=0 THEN LET H=360-H
160 LET L=INT (D+.5)
165 LET M=INT (E+.5)
170 LET O=INT (H+.5)
175 CLS
180 PRINT
183 PRINT "     ANTENNA AIMING PROGRAM      "
185 PRINT
190 PRINT "***** DISTANCE ***** ANGLE *******"
195 PRINT "***** IN MILES *****        *******"
200 PRINT
205 PRINT "********";M;"********";O;"********"
210 PRINT
215 PRINT M;" MILES ARE:"
218 PRINT
220 PRINT L;" NAUTICAL MILES"
225 PRINT
226 PRINT
227 PRINT
230 PRINT "TO CONTINUE, ENTER Y/N"
235 INPUT P$
240 IF P$<>"Y" THEN STOP
245 CLS
250 GOTO 35
255 CLS
260 SAVE "ANTAIM"
265 GOTO 5
```

BARTER 'N' BUY

Individual (noncommercial) . . . . 25¢ per word
Commercial . . . . 60¢ per word

Prepayment by check or money order is required with your ad. No discounts or commissions are available. Please make your payment to *73*. Rates for multiple insertions are available on request.

Advertising must pertain to amateur radio products or services. No special layouts or positions are possible. All advertising copy must be submitted typewritten (double-spaced) and must include full name and address. Copy limited to 100 words, maximum. Count only words in text. Address, free.

73 cannot verify advertising claims and cannot be held responsible for claims made by the advertiser. Liability will be limited to making any necessary corrections in the next available issue.

Copy must be received in Peterborough by the 5th of the second month preceding the cover date.

Make checks payable to *73* Magazine and send to: Ross Kenyon, Advertising Department, *73* Magazine, 80 Pine Street, Peterborough NH 03458.

MOBILE IGNITION SHIELDING. Free literature. Estes Engineering, 930 Marine Drive, Port Angeles WA 98362. BNB006

MILITARY TECHNICAL MANUALS for old and obsolete equipment. 60-page catalog, $3.00. Military Technical Manual Service, 2286 Senasac Ave., Long Beach CA 90815. BNB045

IMRA—International Mission Radio Association helps missionaries by supplying equipment and running a net for them daily except Sunday, 14.280 MHz, 1900-2000 GMT. Br. Bernard Frey, 1 Pryer Manor Rd., Larchmont NY 10538. BNB123

NEW HAM-SWL SOCIETY for unity of thought & learning. Open to all. Many topics, awards, free ad space in periodical, society net, museum participation. Shack pics & QSLs welcome. Writers needed. SASE for info to RCSW, 32 Applegate, Bennington VT 05201. BNB197

SCHEMATICS: Radio receivers 1920s/60s. Send name, brand, model no., SASE. Scaramella, PO Box 1, Woonsocket RI 02895-0001. BNB214

HAM RADIO REPAIR, tube through solid state. Robert Hall Electronics, PO Box 8363, San Francisco CA 94128; (408)-729-8200. BNB219

COMMODORE 64 CW INSTRUCTOR PROGRAM. Generates CW on TV speaker. Random code, keyboard input, or prerecorded "CW Tests." Character speed and spacing set independently. Designed for classes and increasing code speed. $15.00—diskette or cassette (specify). N7BCU, Dennis Olver, 22000 S. Tonya Ct., Beavercreek OR 97004. BNB249

QSLS to order. Variety of styles, colors, card stock. W4BPD QSLs, PO Drawer DX, Cordova SC 29039. BNB260

THE DX'ERS MAGAZINE. Up-to-date, informative, interesting. Compiled and edited by Gus Browning W4BPD, DXCC Honor Roll Certificate #4. Send for *free* sample and subscription information today. PO Drawer DX, Cordova SC 29039. BNB261

CASH PAID for traffic/speed radar equipment. Write or call: Brian R. Esterman, PO Box 8141, Northfield IL 60093; (312)-251-8901. BNB271

KENWOOD 430S owners only! Stop Scan—when the squelch breaks, the scan stops! Adjustable resume scan delay. No modifications! Kit $25, assembled $35. JABCO, R1 Box 386, Alexandria IN 46001. BNB275

WHY SELL IT? You can donate that unwanted equipment, get the tax break, and feel like a million. Contact the kids learning English via amateur radio at Junior High 22 on Manhattan's Lower East Side. WB2JKJ, Junior High School 22 ARC, 111 Columbia Street, New York, NY 10002. BNB276

COPY SATELLITE PHOTOGRAPHS, weather maps, and press on our military-surplus facsimile recorders. Recorders are solid-state, dual-speed, and fully automatic. Catalog available. Atlantic Sales, 3730 Nautilus Ave., Brooklyn NY 11224; (718)-372-0349. BNB280

DIGITAL AUTOMATIC DISPLAYS for FT-101s, TS-520s, Collins, Swan, and all others. Six 1/2" digits in a 5" wide by 1-1/2" high and 9" deep metal cabinet. Send $1.00 for information. Grand Systems Dept. A, PO Box 3377, Blaine WA 98230. Canadians contact VE7LB. BNB282

ATLAS 350XL OWNERS GROUP. Free newsletter. Send QSL with rig s/n and SASE. Know people who repair them? Information to share? Questions? Rod N5NM, Box 2169A, Santa Fe NM 87501. BNB291

KNOW FIRST! You need the *W5YI Report*, a twice-monthly award-winning hot insider ham-radio newsletter. Acclaimed best! Confidential facts, ideas, insights, nationwide news, technology, predictions, alerts! Quoted coast-to-coast! We print what you don't get elsewhere! $21.00 annually w/money-back guarantee! SASE (2 stamps) brings free sample. *W5YI Report*, PO Box #10101, Dallas TX 75207. BNB294

TI 99/4A random, text, keyboard, send, receive, code-practice programs. Dr. Code "General" sends International Morse Code and prints on screen; you choose speed, tone, which characters to be sent, spacing, and more! Dr. Code "Speech" is the same as "General," with speech; you choose how many characters before speech check. For cassette of both copyrighted programs and conditional copying privileges, send $10.00 plus $3.00 shipping and handling to N5ESF, Rt. 1, Box 1326, Lake Charles LA 70601. Phone (318)-436-2048, no collect calls please; satisfaction or money back. BNB299

COCO AMTOR/RTTY/ASCII/CW. Full-feature software ROM pack for TRS-80C, $89. Matching clock/PTT controllers, $24. CW interface, $29, including airmail postage. Visa/Mastercard accepted. Requires conventional RTTY TU. Very popular in UK, newly available in US from England's top quality radio software house. Grosvenor Software, 22 Grosvenor Road, Seaford, Sussex BN25 2BS, England. BNB302

COMPLETE two-meter repeater with Advanced Computer Controls RC-850 controller, full telemetry, link radio, and many other extras for sale. Excellent condition. Doug Zastrow WB0UPJ, 1702 Alaska, Norfolk NE 68701. Phone (402)-379-3166 days, (402)-379-1166 evenings. BNB303

CODE-PRACTICE PROGRAMS diskette for IBM PC, PCjr. $10 pp. Andrew Modla/73, 5 Derby Place, Newtown PA 18940. BNB306

HIGH-QUALITY, LOW-COST courtesy beepers for your transmitter or repeater. Kit $14, assembled $18 F.O.B. YBM Enterprises, 8502 N. Oketo Ave., Niles IL 60648. BNB309

FIND OUT what else you can hear on your general-coverage transceiver or receiver. Join a shortwave radio listening club. Complete information on major North American clubs and sample newsletter, $1.00. Association of North American Radio Clubs, 1500 Bunbury Drive, Whittier CA 90601. BNB310

INDIVIDUAL PHOTOFACT FOLDERS: #1 to #1400 $3.00 postpaid. AJL, 414 Chestnut Lane, East Meadow NY 11554. BNB312

COMMODORE 64 5-Band DXCC Log includes custom beam beadings and distances to DX, plus continent, country, zones QSOed/QSLed on any band, phone or CW, upon country name or callsign entry. Diskette and instructions $18.99 US ppd. Sondor Software, PO Box 416, Sarnia, Ontario, Canada N7T 7J2. BNB313

FOR SALE: Kenwood TR-7800, manual, PL, courtesy beeper, $290 or best offer. Klaus Spies WB9YBM, 8502 N. Oketo Ave., Niles IL 60648. BNB314

SIMPLE—No-chemical printed-circuit-board process. $3.00 postpaid. Ken Hand WB2EUF, PO Box 708, East Hampton NY 11937. BNB315

COMPUTERIZE YOUR IC-720. Keyboard frequency entry, 64 memories, scanning (frequency, memory, and mode), many more features! Requires no interface, just cable—directions included. For Commodore 64. Cassette $14.75, disk $16.75, ppd. David L. Oliver W9ODK, Route 2, Box 75A, Shevlin MN 56676. BNB316

REPLACE rusted antenna bolts with stainless steel. Small quantities, free catalog. Elwick, Dept. 542, 230 Woods Lane, Somerdale NJ 08083. BNB317

BIG ADVERTISEMENTS don't make the computer store. Buy from hams: WA2AJQ, WA2DKC, KA8JVJ. Call or write (SASE) for best prices. Sanyo, Columbia, Zenith, Panasonic, Silver-Reed, NEC, Commodore/Apple/Atari accessories, books, disks, modems, monitors. Open till 2100 EDT. 1-2-3 Compute, 110 Catalpa, Royal Oak MI 48067; (313)-399-3990. BNB318

FULL-FEATURED RTTY/ASCII/CW software package for TRS-80 Model III/4. Write for free information package. Clifton J. Turner WB5KCQ, 6319 Boeuf Trace, Alexandria LA 71301. BNB319

CX7 REPAIRS. Mark Mandelkern, 2315 Derby St., Berkeley CA 94705; (415)-549-9210. BNB320

SPECIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices, 73 Magazine, Pine St., Peterborough NH 03458.

CEDARBURG WI
MAY 4

The Ozaukee Radio Club, Inc., will sponsor its seventh annual swapfest on Saturday, May 4, 1985, from 8:00 am to 1:00 pm, at the Circle B Recreation Center, Highway 60, Cedarburg WI (20 miles north of Milwaukee). Admission is $2.00 in advance and $3.00 at the door. Four-foot tables are $2.00 each and are available in advance only. Refreshments will be available. Seller setup begins at 7:00 am. For tickets, tables, maps, or more information, send a business-size SASE to 1985 ORC Swapfest, 101 E. Clay Street, Saukville WI 53080.

ROGERS AR
MAY 4

The Northwest Arkansas Amateur Radio Club, Inc., will hold its fifth annual hamfest/swapfest on Saturday, May 4, 1985, from 8:00 am to 4:00 pm, at the Rogers Youth Center, 315 West Olive, Rogers AR. Setup begins at 7:00 am. Admission is free, and commercial and flea-market tables are $2.00—first come, first served. Talk-in on 146.16/.76 and 146.52 simplex. For more information, send an SASE to either Ray Watson N5HAP, 714 Maple Drive, Springdale AR 72764, or to Dave Perry KE5QZ, 3201 N. 13th Street, Rogers AR 72756.

BEMIDJI MN
MAY 4

The Bemidji Amateur Radio Club will hold its annual hamfest/swapfest on Saturday, May 4, 1985, from 9:00 am to 4:00 pm, at the Middle School cafeteria, Bemidji MN. Licensing exams will be given. Talk-in on 146.13/.73. For more information, write Jerry Pottratz, Bemidji Amateur Radio Club, PO Box 524, Bemidji MN 56601; (218)-751-7502.

OLD-TIMERS DAY
MAY 4

The Volunteer Amateur Radio Club of Dickson TN will operate special-event station NY4N on Old-Timers Day, May 4, 1985. Times and frequencies are as follows: 12:00 noon to 2:00 pm—3980 kHz; 2:00 pm to 6:00 pm—14.275 kHz; 12:00 noon to 6:00 pm—146.520 and 145.11 MHz. For a commemorative certificate, QSL to PO Box 74, Burns TN 37029.

OWEGO NY
MAY 4

The Southern Tier ARC will sponsor its 26th annual hamfest on Saturday, May 4, 1985, beginning at 8:00 am, at the Treadway Inn, Owego NY (take NY Route 17 to Exit 65). Admission is $4.00, with children under 14 admitted free. Flea-market/tailgating parking is $2.00 (plus admission for each person). Features include vendor displays, talks, and refreshments. There will be a dinner at 6:30 pm ($15.00, includes general admission—advance tickets only). For banquet tickets (make checks payable to STARC), write to STARC, PO Box 7082, Endicott NY 13760. Talk-in on .22/.82, .16/.76, and .52. For more information, send an SASE to KF2X, RD #1, Box 144, Vestal NY 13850.

COCHISE COUNTY AZ
MAY 4-5

The Cochise Amateur Radio Association (CARA) invites all amateurs to participate in the dedication of the new CARA Training Facility and Range. The inaugural event for the complex will be a hamfest on May 4-5, 1985. A flea market is planned and tailgaters are welcome. The new facility is located 5 miles east of Sierra Vista AZ on Moson Road, off of Highway 90 East. For more information, contact the Cochise Amateur Radio Association, PO Box 1855, Sierra Vista AZ 85636, Attn: KB7HB.

GREENVILLE SC
MAY 4-5

The Blue Ridge Amateur Radio Society will sponsor the 46th annual Greenville Hamfest and Electronics Flea Market on Saturday, May 4, 1985, from 8:00 am to 5:00 pm, and Sunday, May 5, 1985, from 8:00 am to 3:00 pm, at the American Legion Fairgrounds, Greenville SC. Admission is $3.00 in advance and $4.00 at the gate. There will be licensing exams, a Wouff Hong ceremony, the South Carolina ARRL State Convention, 25,000 square feet of dealer displays, an indoor/outdoor flea market, a Saturday-night banquet, camping, and more. For advance tickets or for VEC exam information, write Mrs. Sue Chism N4ENX, PO Box 6751, Greenville SC 29606. For more information, contact Mr. Rancy Rice WD4ADK, 1401 W. Parker Road, Greenville SC 29611.

SHELTON WA CENTENNIAL
MAY 4-5

The Mason County ARC will be operating special-event stations on May 4-5, 1985, to celebrate the centennial of Shelton WA. KB7MJ and W7KTI will be operating SSB on 3900, 7230, 14,270, 21,350, and 28,600. KN7D will be operating RTTY on 14,090. K7UAR will be operating packet on 145.01. For a certificate, send a QSL and a 9 × 12 SASE to Loren Mercer KA7GSV, 2213 Olympic Highway North, Shelton WA 98584.

MELVILLE NY
MAY 5

The Suffolk County Radio Club will sponsor an indoor/outdoor electronics flea market on Sunday, May 5, 1985, from 8:00 am to 3:00 pm, at Republic Lodge #1987, 585 Broadhollow Road (Route 110), Melville NY. Admission is $2.00 (spouses and children under 12 are free). Indoor sellers' tables are $7.00 and outdoor space is $5.00 and includes one free admission. Free parking and refreshments will be available. Talk-in on 144.61/145.21 and 146.52. For more information, call Richard Tygar AC2P at (516)-643-5956 evenings.

SULLIVAN IL
MAY 5

The Moultrie Amateur Radio Klub (MARK) will hold a hamfest on Sunday, May 5, 1985, from 8:00 am to 3:00 pm, at the Moultrie County 4-H Fairgrounds, five miles east of Sullivan IL. There will be a heated indoor and large covered outdoor flea market. There is no charge to vendors, and space is available on a first-come, first-served basis. Vendors can set up on Saturday, May 4, but there are no overnight hookups. Talk-in on .655/.055 and .52. For more information, write MARK, PO Box 79, Sullivan IL 81951, or call Vernon Jack K9SWY at (217)-728-7596.

CENTRALIA IL
MAY 5

The Centralia Wireless Association, Inc., will hold its annual hamfest on Sunday, May 5, 1985, at the Kaskaskia College gymnasium, three miles northwest of Centralia IL. Flea-market and display setup will begin at 7:00 am. Admission is free and a limited number of tables will be provided on a first-come, first-served basis. Food and free parking will be available. Talk-in on 147.27/.87. Examinations for all classes of license (except Novice) will be given at 9:00 am. To register for the exams, send (by April 5) an FCC Form 610, a copy of your current license, and a check for $4.00 (payable to ARRL/VEC) to Lou Hodges W9IL, Route 1, Box 62A, Centralia IL 62801. For more information, contact David Conder KA9QPC at (618)-532-2772 or Lou Hodges W9IL at (618)-533-4724.

ROSEVILLE CA
MAY 5

The 13th annual Sacramento Valley Amateur Radio Hamswap will be held on Sunday, May 5, 1985, from 9:00 am to 3:00 pm, at the Placer County Fairgrounds, Roseville CA. Swap tables will be available. There will be food and free parking. Talk-in on 145.190 and 224.780 (K6IS repeaters). For ticket and table information, contact Carl Schultz KA6KWB, 2942 Gwendolyn Way, Rancho Cordova CA 95670; (916)-366-9111.

SANDWICH IL
MAY 5

The Kishwaukee Amateur Radio Club will hold its annual hamfest on Sunday,

May 5, 1985, at the DeKalb County Fairgrounds, on Suydam Road just north of Route 34, between Routes 23 and 47. Admission is $2.00 in advance and $3.00 at the gate. Inside display tables are $5.00 each. All parking is free and there will be outside areas for tailgating. Overnight camping will be available (no hookups). Food will also be available. Talk-in on 146.94 and 146.13/.73. For more information or for tickets, write to KARC, Box 334, Sycamore IL 60178.

WEST SPRINGFIELD MA
MAY 5

The Hampden County Radio Association will hold a flea market on Sunday, May 5, 1985, rain or shine, from 9:00 am to 3:00 pm, at the Elks Lodge, Morgan Road, West Springfield MA (Morgan Road is approximately one-half mile south of the Massachusetts Turnpike on Route 5. Turn right onto Morgan Road at Abdows Restaurant and drive three-quarters of a mile to the Elks Lodge). Admission is $1.00 and tables are $3.00 each. Dealers may display from vehicles for $3.00 per vehicle. Refreshments will be available.

BBQ FESTIVAL
MAY 10-11

The Owensboro ARC will operate K4HY from the International BBQ Festival, from 0000 UTC on May 10, 1985, through 0530 UTC on May 11, 1985. Frequencies of operation will be: phone—7245, 28540, and 28815; CW—7125. A certificate is available for an SASE to Ray Tate N4EKG, 1615 East 23rd Street, Owensboro KY 42301.

DULUTH MN
MAY 11

The Arrowhead Radio Amateur Club will sponsor Swapfest 85 on May 11, 1985, from 10:00 am to 3:00 pm, at the Holiday Inn, 207 West Superior Street, Duluth MN. May 11 has been proclaimed "Amateur Radio Day" by the mayor of Duluth. Admission is $4.00 and 4-foot tables are $5.00. Setup begins at 8:00 am. There will be plenty of food and free parking. Other activities include a cocktail hour, a banquet ($15.00), and much more. Talk-in on .34/.94. For admission, table or banquet advanced registration, or Holiday Inn room rates, contact Bill Cossette N0BKL, 15 Manitou Street, Duluth MN 55808; (218)-624-7188.

CADILLAC MI
MAY 11

The Wexaukee Amateur Radio Association will hold its 25th annual Swap Shop and Computer Fair on Saturday, May 11, 1985, at the Wexford Civic Arena, Cadillac MI. Camping will be available. Transportation will be available for anyone wishing to fly in. Talk-in on 146.37/.97 (WA8SUE). For more information, contact Wexaukee Amateur Radio Association, PO Box 163, Cadillac MI 49601.

FIRE SERVICE RECOGNITION DAY
MAY 11

Fire Service Recognition Day will be celebrated by special-event station KF6XX on May 11, 1985, from 1700 to 2200 UTC. KF6XX (the call held by Bill Bisson, the Los Angeles Fire Department's Arson Section Battalion Chief) will be operated from Los Angeles City Fire Station 88, 5101 Sepulveda Boulevard, Van Nuys CA, on 15- and 20-meter SSB. On display at Fire Station 88 will be equipment from local firefighting agencies, including helicopters, tractors, bulldozers, and all types of fire engines and trucks. Fire prevention and lifesaving techniques will also be demonstrated. All licensed hams are welcome to stop by operating headquarters, the Arson Section Response Van, to sign the guest log and operate. Custom QSO confirmation certificates are available for a QSL sent to KF6XX, PO Box 939, Camarillo CA 93010.

BATON ROUGE LA
MAY 11-12

The Baton Rouge Amateur Radio Club will hold its annual hamfest on Saturday and Sunday, May 11-12, 1985, from 8:30 am to 5:00 pm on Saturday, and from 8:30 am to 2:00 pm on Sunday, at the campus of Catholic High School, Baton Rouge LA. Admission is free. Featured will be a swapfest, forums, and new-equipment dealers. Talk-in on 146.79–. There will be VE exams (through Extra class) from 9:00 am to 12:00 noon on both days. There is a 30-day advance registration deadline for the exams. Send an SASE, Form 610, and a check for $4.00 payable to ARRL/VEC to George Perry W5LVX, 17424 Lady Constance, Greenwell Springs LA 70739. For further information, send an SASE to Rick Pourciau N5HHF, 879 Castle Kirk Drive, Baton Rouge LA 70808.

MEDINA COUNTY OH
MAY 12

The Medina Two Meter Group will sponsor the Medina County Hamfest on May 12, 1985, from 8:00 am to 2:00 pm, at the Medina County Community Center Building, Lafayette Road, State Route 42 SW, Medina County OH. Admission is $3.00 in advance and $3.50 at the door. Tables are $6.00 each and flea-market spaces are $2.00 each. Setup begins at 7:00 am. Refreshments and free parking will be available. Talk-in on 147.63/.03 (K8TV/R). For more information, table reservations, or advance tickets, contact the Medina County Hamfest, PO Box 452, Medina OH 44258; (216)-725-5021.

CHICAGO IL
MAY 15

The Chicago Amateur Radio Club (CARC) will hold a mini-hamfest on Wednesday, May 15, 1985, from 6:00 pm to 10:00 pm, at the Edgebrook Golf Course field house, 5900 N. Central Avenue (north of Elston Avenue, south of Devon Avenue), Chicago IL. For more information, call (312)-545-3622.

MANASSAS VA
MAY 18

The Ole Virginia Hams Amateur Radio Club of Manassas VA will sponsor a special-event station on May 18, 1985, from 8:00 am to 8:00 pm, at the Manassas Battlefield Park, Manassas VA. Frequencies will be: Novice—3.725, 7.125, and 21.050; General phone—3.950, 7.290, 14.290, and 21.390; General CW—3.650, 7.050, 14.050, and 21.050. QSL to Ole Virginia Hams ARC, PO Box 1255, Manassas VA 22110.

ARMED FORCES DAY 1985
"PRESERVING THE PEACE"
MAY 18

The annual Armed Forces Day Communication Test will be held on Saturday, May 18, 1985, and marks the 36th anniversary of this event which emphasizes a continuing climate of mutual assistance and warm esteem between the military and amateur-radio communities. The traditional military-to-amateur crossband operation and broadcast of the Secretary of Defense message are the featured highlights of the day, which includes operation in CW, SSB, RTTY, and SSTV.

These tests give both amateur-radio operators and SWLs an opportunity to demonstrate their individual technical skills. Special commemorative QSL cards will be awarded to those amateur-radio operators achieving a verified two-way radio contact with any of the participating military radio stations. Interception of these contacts by SWLs will not be acknowledged by QSL cards. However, anyone who receives and accurately copies the Armed Forces Day CW and/or RTTY message from the Secretary of Defense can qualify to receive a special commemorative certificate from the Secretary.

Crossband contacts: The military-to-amateur crossband operations will be conducted from 1300 UTC on May 18 to 0245 UTC on May 19. The military stations participating in crossband operations will be:

AIR
2045th Comm. Group
Andrews AFB
Washington DC

NAM
Naval Comm. Area
Master Station LANT
Norfolk VA

NAV
Hq. Navy-Marine Corps
MARS Radio Station
Cheltenham MD

NMH
Coast Guard Radio Station
Alexandria VA

NMN
Coast Guard Comm. Station
Portsmouth VA

NPG
Naval Comm. Station
Stockton CA

NPL
Naval Comm. Station
San Diego CA

NZJ
Marine Corps Air Station
El Toro CA

WAR
Hq. Army MARS Radio Station
Fort Meade MD

Military stations will transmit on the following frequencies and announce the specific amateur band frequency being monitored:

Frequency (kHz)	Emission	Station
4001.5	LSB	NPG
4010.0	CW	NPG
4015.0	CW	NMH
4025.0	LSB	AIR
4028.5	LSB	WAR
6970.0	CW	NPG
6995.5	CW	AIR
6997.5	CW	WAR
7301.5	LSB	NPG
7306.5	RTTY	AIR
7315.0	LSB	AIR
7346.5	LSB	NMH

7365.0	CW	NPG
7372.5	RTTY	NAV
7375.0	RTTY	NZJ
7382.5	RTTY	NPL
7393.0	Varied	NMN
10259.5	CW	NPG
13514.0	RTTY	WAR
13927.5	RTTY	NPG
13975.5	CW	NPG
13986.5	RTTY	AIR
13992.5	USB	WAR
13997.5	CW	AIR
14375.0	USB	NPG
14385.0	SSTV	NPL
14389.5	SSTV	NAV
14400.0	Varied	NAM
14403.5	CW	WAR
14408.0	USB	AIR
14440.0	RTTY	NMH
14480.0	USB	NZJ
20937.5	USB	NMH
20995.5	USB	WAR
20998.5	CW	NPG
21460.0	USB	NPG

Receiving test: The CW and the RTTY broadcasts will be special Armed Forces Day messages from the Secretary of Defense to any amateur-radio operator or SWL desiring to participate. A 10-minute tuning call will precede each transmission. The CW broadcast will be transmitted at 25 wpm beginning at 0300 UTC on May 19. The RTTY broadcast will begin at 0345 UTC on May 19 at 60 wpm using 170-Hz shift. Both the CW and the RTTY broadcast will be transmitted from the following stations on the listed frequencies:

AIR—6995.5, 13997.5
NAM—4005, 7393, 14400
NAV—7372.5, 14389.5
NPG—4010, 7365, 13975.5
WAR—4028.5, 6997.5, 14403.5.

Submission of test entries: Transcriptions of the CW and/or RTTY receiving tests should be submitted "as received." No attempt should be made to correct possible transmission errors. The time, frequency, and callsign of the military station copied as well as the name, callsign and address of the individual submitting the entry must be indicated on the page containing the test message. Entries must be postmarked no later than May 25, 1985, and submitted to the respective military commands as follows: AIR—Armed Forces Day Test, 2045CG/DONJM, Andrews AFB, DC 20331-5000; NAM, NAV, NPG—Armed Forces Day Test, 4401 Massachusetts Ave., Washington DC 20390-5290; WAR—Armed Forces Day Test, Commander, USAISC, Attn: AS-OPS-CM, Ft. Huachuca AZ 85613-5000.

ARMED FORCES DAY—W4ODR
MAY 18

The 36th Armed Forces Day will be celebrated on Saturday, May 18, 1985, from 1400 to 2200 UTC. ARS W4ODR, located at Naval Air Station Memphis, Millington TN, will be operated by active-duty, reserve, and retired sailors and Marines. Plans call for SSB operation on 7.230, 14.280, and 21.370 MHz (± 10 kHz). CW frequencies will be 21.145 and 28.145 MHz. 2-meter operation will be on 146.52 simplex. A special red, white, and blue certificate will be available to anyone who works W4ODR. No SASE is required. Calls not in the *Callbook* should QSL to: Military Club Station W4ODR, PO Box 54278, Naval Air Station Memphis, Millington TN 38054.

ANDERSON SC
MAY 18–19

The Lake Hartwell Hamfest will be held on May 18–19, 1985, at the Lake Hartwell Group Camp, on Highway 29, south of Anderson SC. Admission, camping, and flea-market spaces are *all free*. Campsites with hookups are available at nearby State Parks. The South's most relaxed hamfest will feature camping, fishing and boating on beautiful Lake Hartwell, bingo, a horseshoe tournament, and other activities for the whole family. The campground will open at 5:00 pm Friday and hamfest activities will begin at 9:00 am on Saturday. Talk-in on 146.79 and 147.33. For further information, contact Carl Davis KY4T, 203 College Avenue, Hartwell GA 30643; (404)-376-3606.

LIMA OIL CENTENNIAL
MAY 18–19

The amateurs of Lima and Allen County OH will operate special-event stations on May 18–19, 1985, to commemorate the discovery of oil in Lima. Participating stations will sign /OIL and will operate in the Novice, Technician, and General portions of the bands. To receive a certificate, send an SASE to the Northwest Ohio ARC, PO Box 211, Lima OH 45801.

PENN WIRELESS ASSOCIATION
MAY 18–19

The Penn Wireless Association, Inc., will operate special-event station W3SK from 1400 UTC on May 18, 1985, to 0200 UTC on May 19, 1985, to commemorate its 20th anniversary. Intermittent operation will be conducted during the week preceding these dates. Frequencies are: phone—3.98, 7.28, 14.28, 21.38, 28.58, and 146.52 FM, and 144.12 SSB; CW—3.54, 3.745, 7.04, 7.145, 14.04, 21.04, 21.195, 28.04, and 28.195. To receive a certificate, send a 9 × 12 SASE to PO Box 734, Langhorne PA 19047.

HARTWELL GA
MAY 18–19

The Anderson, Hartwell, and Toccoa Amateur Radio Clubs will sponsor the sixth annual Lake Hartwell Hamfest on May 18–19, 1985, at the Lake Hartwell Group Camp, on Highway 29, four miles north of Hartwell GA. Admission, flea-market space, and camping are all free. Activities include a left-footed CW contest, horseshoes, bingo, fishing, swimming, and other family activities. The campgrounds open at 6:00 pm on Friday. Talk-in on 146.19/.79, 147.93/.33, and 146.895/.295. For further information, contact Ray Pettit WB4ZLG, Route 1, Dooley Drive, Toccoa GA 30577.

WABASH IN
MAY 19

The Wabash County ARC will sponsor the 17th annual Wabash Hamfest on May 19, 1985, from 6:00 am to 4:00 pm, at the Wabash County 4-H Fairgrounds, State Road 13, Wabash IN. Admission is $2.75 in advance and $3.25 at the gate. There will be free overnight parking at the fairgrounds. Food will be available. Talk-in on 147.63/.03, 146.52, and 146.94. For information or advance tickets, send an SASE to Don Spangler, 235 Southwood Drive, Wabash IN 46992; (219)-563-5564.

VE1 ABEGWEIT AWARD
MAY 19

The Prince Edward Island Amateur Radio Association is offering the VE1 Abegweit Award to amateurs contacting PEI stations. Abegweit is the earliest name for Prince Edward Island and is a Micmac Indian name meaning "cradled on the waves." To earn the award, VE1 and VO1 stations must confirm contacts in all three PEI counties (Prince, Queens, and Kings). All other VEs and US amateurs must confirm contacts with any three PEI stations, regardless of county. DX amateurs must confirm contacts with any two PEI stations, regardless of county. Contacts after January 1, 1960, are valid for the award. On May 19, 1985, from 1200 UTC to 2400 UTC, the PEIARA will provide an opportunity for amateurs to work PEI stations. The frequencies are: CW—21.100, 14.050, 7.100, 3.700; SSB—21.300, 14.250, 7.200, 3.800. Frequencies may change due to band conditions, and the PEIARA will not be on all bands at the same time. Send a copy of your log (certified by two other amateurs) and $2.00 or 10 IRCs to PO Box 1232, Charlottetown, Prince Edward Island, Canada C1A 7M8. For more information about the award or the May 19th operation, contact David A. Smith VE1CIK, Box 529, Kensington, Prince Edward Island, Canada C0B 1M0, or call (902)-836-4246 after 2200 UTC.

STIRLING NJ
MAY 19

The Tri-County Radio Association will hold a hamfest on May 19, 1985, from 9:00 am to 4:00 pm, at the Passaic Valley Community Center, off Valley Road, Stirling NJ. Admission is $2.50 and tables are $10.00. Tailgating is by reservation only. Refreshments and free parking will be available. For more information or for reservations, contact Dick Franklin W2EUF, PO Box 182, Westfield NJ 07090; (201)-232-5955 or (201)-270-3193.

KNOXVILLE IL
MAY 19

The Knox County Amateur Radio Club, Inc., will sponsor a hamfest on May 19, 1965, rain or shine, at the Knox County Fairgrounds, Knoxville IL (turn right at Exit 51 off of I-74). Tickets are $2.00 in advance and $3.00 at the gate. Camping is available. Food will be provided by the Knox County Pork Producers Association (pork chops and pork burgers). For more information, contact Keith Watson, 119 South Cherry Street, Galesburg IL 61401.

WRIGHTSTOWN PA
MAY 19

The Warminster Amateur Radio Club will sponsor a hamfest on May 19, 1985, beginning at 7:00 am, at the Middletown Grange Fairgrounds, Penns Park Road, Wrightstown PA (about 15 miles north of Philadelphia). Admission is $3.00, with XYLs and children admitted free. Indoor spaces are $5.00 (includes 8-foot table and power) and outdoor tailgate spaces are $5.00. Vendor setup begins at 6:00 am. Refreshments will be available. Talk-in on 147.69/.09 and 147.52. For more information, contact Bill Cusick W3GJC, Apt. 706, Garner House, Hatboro PA 19040; (215)-441-8048.

PITTSBURG KS
MAY 19

The Pittsburg Repeater Organization will hold its annual hamfest on May 19, 1985, from 10:00 am to 5:00 pm, in Lincoln Park, Pittsburg KS. Admission is $5.00 per ham (includes chicken and pop for the family). Features include a flea market, license examinations, and a covered-dish dinner (please bring a covered dish). For more information, table reservations, or to notify the PRO of your intent to take an exam, contact Steve Cooper, PRO Hamfest, PO Box 1303, Pittsburg KS 66762.

OAK HARBOR OH
MAY 19

The Sandusky Valley ARC will sponsor a combined Sandusky County and Ottawa County hamfest on May 19, 1985, at the Ottawa County Fairgrounds, State Route 163, 3 miles east of Oak Harbor OH. Admission is $2.50 in advance and $3.00 at the door. Tailgating spaces, tables, and free parking will be available. Talk-in on 147.675/.075 and .52. For more information, contact Raymond Kruse K8IDA, 18980 West S.R. 51, Elmore OH 43416.

DALTON MA
MAY 19

The Northern Berkshire Amateur Radio Club will sponsor a hamfest on Sunday, May 19, 1985, beginning at dawn, at the Dalton American Legion, Route 9, Dalton MA. Admission is $1.00, with XYLs, YLs and children admitted free. A few tables will be available at no charge on a first-come, first-served basis. Food will be available. Free overnight camping will be permitted on Saturday night (May 18) beginning at 6:00 pm. Talk-in on 146.91.

ATHENS OH
MAY 19

The Athens County Amateur Radio Association will hold its sixth annual hamfest on Sunday, May 19, 1985, from 8:00 am to 3:00 pm, at the City Recreation Center, East State Street, Athens OH. Admission is $3.00. Spaces in the paved flea-market area can be claimed by tailgaters and people with their own tables on the day of the event. Indoor space is available only by advanced registration. Talk-in on 146.34/.94. For inside space reservations, contact Joe Follrod NE8R, 15 Roy Avenue, The Plains OH 45780; (614)-797-4874. For more information, write to Carl J. Denbow KA8JXG, Chairman, ACARA Hamfest Committee, 83 Morris Avenue, Athens OH 45701.

PARAMUS NJ
MAY 19

The Bergen ARA will hold a ham Swap 'n' Sell on Sunday, May 19, 1985, from 8:00 am to 4:00 pm, at Bergen Community College, 400 Paramus Road, Paramus NJ. There will be tailgating only—bring your own table. Admission is free ($4.00 for sellers). Amateur license exams will be given. Talk-in on .79/.19 and .52. For more information, contact Pete Adely K2MHP, 13-30 Edwards Street, Fairlawn NJ 07410; (201)-796-6622 nights.

TRACY, QUEBEC
MAY 26

The Quebec Provincial Hamfest will be held on Sunday, May 26, 1985, beginning at 9:00 am, at the Tracy Curling Club. Admission is $4.00, and 8-foot tables are $5.00 (outdoor) and $6.00 (indoor). Tables must be reserved by May 20. Setup begins at 8:00 am. For more information, contact the Sorel-Tracy ARC, PO Box 533, Sorel, Quebec, Canada J3P 2L5.

WEST FRIENDSHIP MD
MAY 26

The Maryland FM Association will hold its annual hamfest on Sunday, May 26, 1985, from 8:00 am to 4:00 pm, at the Howard County Fairgrounds, West Friendship MD (about 30 miles west of Baltimore on I-70). Admission is $3.00. Tables are $6.00 in advance and $10.00 the day of the hamfest (if available). Talk-in on 146.16/.76, 222.16/223.76, and 449.1/444.1. For more information or for table reservations, contact Craig Rockenbauch WA3TID, 429 Severnside Drive, Severna Park MD 21146; (301)-987-6042 (6:00-10:00 pm).

BLACKSBURG VA
MAY 30—JUN 1

Virginia Polytechnic Institute and State

University will hold a workshop, Personal Computer and STD Computer Interfacing for Scientific Instrument Automation, on May 30–June 1, 1985, at Virginia Tech, Blacksburg VA. The hands-on workshop, directed by Mr. David E. Larsen and Dr. Paul E. Field, is $450.00 for three days. Participants will be wiring and testing interfaces. For more information, write Dr. Linda Leffel, CEC, Virginia Tech, Blacksburg VA 24061, or phone (703)-961-4848.

SEASIDE OR
MAY 31–JUN 2

The North Coast Repeater Association and the Oregon Tualatin Valley ARC will sponsor the fifth annual Oregon State Ham Convention from May 31, 1985, through June 2, 1985, at the Seaside Convention Center, Seaside OR. The convention hall hours will be: Friday, May 31—5:00 pm to 8:00 pm; Saturday, June 1—8:00 am to 5:00 pm; Sunday, June 2—9:00 am to about 2:00 pm. The convention will feature commercial/dealer exhibits, seminars, VE testing, a flea market, and a banquet. For more information, contact OTVARC, PO Box 5132, Beaverton OR 97006.

GRAND RAPIDS MI
JUN 1

The Independent Repeater Association of Grand Rapids will hold its annual Hamfestival on June 1, 1985, from 8:00 am to 4:00 pm, at the Wyoming National Guard Armory on 44th Street, west of US-131. Admission is $3.50. Programs include satellite operation, packet radio, a CW copying contest, a shack picture contest, entertainment films for non-hams, and more. There will be a 15,000-square-foot indoor swap area and table space is free for all sellers. Dealer setup begins at 6:00 am. Talk-in on .165/.765. For more information or for table reservations, call Paul Gardner WD8IZB at (616)-538-8241 or write to IRA, 562 92nd Street SE, Byron Center MI 49315.

ST. PAUL MN
JUN 1

The North Area Repeater Association will sponsor a swapfest and exposition for amateur-radio operators on Saturday, June 1, 1985, at the Minnesota State Fairgrounds, St. Paul MN. Admission is $4.00 in advance and $5.00 at the door. Exhibits, commercial dealers, VE exams, and a giant outdoor flea market will be featured. There will be free overnight parking for self-contained campers on May 31. Talk-in on .25/.85 and .16/.76. For more information or for advance tickets, write to Amateur Fair, PO Box 857, Hopkins MN 55343; (612)-566-4000.

NH/VT NEIGHBORS DAY
JUN 1

Special-event station W1GUA will be operated from Fort Number 4 in Charlestown NH on June 1, 1985, from 10:00 am to 5:00 pm, to mark New Hampshire/Vermont Neighbors Day. The multi-operator station will be operating 25 kHz up from the bottom of the General portion of the 80-, 40-, and 15-meter CW and phone bands, as well as 2-meter simplex and packet radio. For a commemorative QSL, send a business-size SASE and QSL to Rudy Adler W1GUA, Dodge Hollow Road, Lempster NH 03605, or to WB1GXM, PO Box 428, Claremont NH 03743.

MIDLAND MI
JUN 1

The Central Michigan Amateur Repeater Association will sponsor the 11th annual Midland Hamfest on Saturday, June 1, 1985, from 8:00 am to 2:00 pm, at the Midland Civic Arena, Midland MI. Admission is $3.00 in advance and $4.00 at the door. Tables are $6.00 for a full table, $3.00 for a half table, and trunk sales are $3.00. Setup begins at 8:00 am. Free parking and handicapped parking will be available. VE license exams will be given. Refreshments will be available. Talk-in on 147.60/.00 and 146.52. For advance tickets or more information, contact Raleigh L. Wert W8QOI, 309 E. Gordonville Road, Route 12, Midland MI 48640; (517)-631-5591.

OHIO WINE MONTH
JUN 1–2

The Wireless Institute of Northern Ohio (WINO) will commemorate Ohio Wine Month by operating special-event station KO8O on Saturday, June 1, 1985, from 7:00 pm to 11:00 pm, on 3880 and 7235 kHz, and on Sunday, June 2, 1985, from 11:00 am to 3:00 pm, on 7235 and 14,235 kHz. The station will be located at a winery in Madison OH. For an 8½ × 11 certificate, send a legal-size SASE to: KO8O—WINO Weekend, 7126 Andover Drive, Mentor OH 44060.

HARRY'S HEYDAYS
JUN 1–2

The Southside Amateur Radio Club will operate special-event station NØEWP on June 1–2, 1985 (Harry's Heydays), in honor of President Harry S. Truman's 101st birthday, from near the old Truman farm home in Grandview MO. The station will be on 7235 and 14235 (±QRM). The times of operation will be: June 1, 1700–2400 UTC; June 2, 0001–0400 UTC and 1700–2200 UTC. A commemorative certificate will be available for a 9 × 12 SASE and 33 cents postage. QSL to: Southside Amateur Radio Club, PO Box 412, Grandview MO 64030.

COLUMBUS OH
JUN 2

The Battelle ARC will sponsor the fifth annual Ohio Hamfest on Sunday, June 2, 1985, from 8:00 am to 3:00 pm, at the Ganyard building on the Franklin County Fairgrounds, Columbus OH. Admission is $2.00 in advance and $3.00 at the door. Tables are $3.00 in advance and $4.00 at the door. Talk-in on 146.37/.97. For advance sales, send an SASE to Bill Welch W8LLU, 396 Brevoort Rd., Columbus OH 43214. For more information, call Bill W8LLU at (614)-261-7053 or Kevin WA8OHI at (614)-766-5313.

PITTSBURGH PA
JUN 2

The 31st annual Breeze Shooters Hamfest will be held on Sunday, June 2, 1985, from 9:00 am to 5:00 pm, at the White Swan Amusement Park, PA Route 60 (Parkway West), near the Greater Pittsburgh International Airport. There will be a flea market and family amusement park. Sheltered tables are available by advance registration. Talk-in on 146.28/.88 or 29.000. For further information, contact John Colbert K3SDL, 1831 Highland Avenue, Irwin PA 15842; (412)-863-5167 evenings.

HUMBOLDT TN
JUN 2

The Humboldt Amateur Radio Club will sponsor its annual hamfest on June 2, 1985, from 8:00 am to 4:00 pm, at Bailey Park, 22nd Avenue, Humboldt TN. Admission is $2.00. Features include a flea market, food, parking for RVs (electricity provided, water close by), and alternate activities. Talk-in on .37/.97. For more information, contact Ed Holmes W4IGW, 501 N. 18th Avenue, Humboldt TN 38343.

CHELSEA MI
JUN 2

The Chelsea Swap and Shop will be held on Sunday, June 2, 1985, from 8:00 am to 2:00 pm, at the Chelsea Fairground, Chelsea MI. Admission is $2.50 in advance and $3.00 at the door. Children under 12 and non-ham spouses will be admitted free. Setup begins at 5:00 am. Talk-in on 146.520 simplex and 147.255 (Chelsea Repeater). For more information or advance tickets, contact William Altenberndt, 3132 Timberline, Jackson MI 49201.

PRINCETON IL
JUN 2

The Starved Rock Radio Club will sponsor a hamfest on June 2, 1985, in Princeton IL. Admission is $2.50 in advance (*before May 20*) and $3.00 *at the door*. VE exams will be given and no pre-registration is required. For exam details, send a long SASE to Denny R. Chestney KM9L, 1212 Dogwood, Bloomington IL 61701. For complete hamfest information, contact W9MKS, RFD #1, Box 171, Oglesby IL 61348; (815)-667-4614.

BOWLING GREEN KY
JUN 8

The Kentucky Colonels ARC will hold its annual hamfest on June 8, 1985, beginning at 8:00 am, at the Jaycee Pavilion (inside a/c) on the So. Kentucky Fairgrounds, off US 231 North, Bowling Green KY. Admission is $2.00 and tables are $2.00. Outside setup is free. Refreshments will be available. Talk-in on 146.85/.25. For more information, contact Ed Gann N4HID, 445 Elrod Road, Bowling Green KY 42101; (502)-843-8911.

WIA 75TH ANNIVERSARY

The Wireless Institute of Australia, the world's first radio society, will celebrate its 75th anniversary during 1985. The WIA 75 Award will be available during the period from March 1, 1985, to December 31, 1985. To qualify, amateurs (and SWLs) need to contact (log) 75 members of the WIA. A contact will be valid only if the WIA member's individual membership number is logged. No more than 30 WIA members may be logged in any one callsign area. Send a log extract of the 75 members contacted and $2.00 (Australian) to WIA 75 Award Manager, Wireless Institute of Australia, 412 Brunswick Street, Fitzroy 3065, Victoria, Australia.

SATELLITES

USING THE AO-10 APOGEE PREDICTIONS

Apogee predictions for the month of May are provided for three sections of the United States: Washington DC at 39N 77W, Kansas at 39N 95W, and California at 38N 122W. Times are in UTC and apogee in this case is mean anomaly 128 rounded to the nearest whole hour. Use the chart as a guide in aiming your antenna, then fine-tune the azimuth and elevation values to peak the satellite's beacon signal. If you require more accurate orbital predictions, contact AMSAT at PO Box 27, Washington DC 20044.

AMSAT-OSCAR 10 APOGEE PREDICTIONS
MAY 1985

			WASH		KANSAS		CALIF	
ORBIT	DAY	TIME	AZ	EL	AZ	EL	AZ	EL
1746	1	1500	231	26	212	36	173	43
1748	2	1500	224	27	204	35	166	38
1750	3	1400	212	34	189	39	151	36
1752	4	1300	198	39	172	41	136	31
1754	5	1300	190	37	165	37	133	26
1756	6	1200	174	39	150	34	122	19
1758	7	1100	158	38	137	30	112	12
1760	8	1000	143	34	125	23	104	4
1762	9	1000	139	29	122	18		
1764	10	0900	127	23	113	10		
1766	11	0800	117	16	104	3		
1768	12	0800	115	10				
1769	12	1900					252	7
1770	13	0700	106	3				
1771	13	1900					247	9
1773	14	1800					239	18
1775	15	1700			251	7	230	27
1777	16	1700			245	9	222	27
1779	17	1600	251	5	237	18	210	34
1781	18	1500	243	14	228	26	196	39
1783	19	1500	237	15	221	26	188	37
1785	20	1400	228	24	209	33	172	39
1787	21	1300	217	31	194	38	156	37
1789	22	1200	204	37	178	40	142	33
1791	23	1200	196	36	171	37	138	28
1793	24	1100	181	38	156	35	126	22
1795	25	1000	164	38	142	31	116	15
1797	26	1000	159	34	138	26	115	9
1799	27	0900	144	31	126	20	106	1
1801	28	0800	132	25	116	13		
1803	29	0800	129	20	115	7		
1805	30	0700	119	13	106	0		
1807	31	0600	110	5				
1808	31	1800					249	5

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

I know it might seem hard to believe, at least it is for me, but this month marks the end of the eighth year of "RTTY Loop." We have covered a lot of ground on these pages, and if all is well, we will cover more in the years to come. But before I get too deeply into this month's offering, I just want to thank all of you for your support through these years. Without that it would not have been possible.

Well, plunging right in, I have a letter here from Charles E. Heisler K3VDB of Red Lion PA. Charles has been using one of the commercial RTTY adapters for a small computer and is looking for a simple circuit to put in front of it to improve the signal capture.

You might try the circuit shown in Fig. 1, which is adapted from the input section of the prize-winning RTTY tuning indicator by John Langner WB2OSZ, which was published in the March, 1983, issue of *73*. I have looked at several input filters that use passive coils, active filters, and phase-locked loops, and among all of them I tend to lean toward the phase-locked loop for applications such as this. Audio is coupled via the 0.1-uF capacitor, and back-to-back diodes function as a simple limiter. The 5k potentiometer is adjusted to provide the best capture of the signal, and the output should be a clean square wave that follows the original input frequency.

By the way, the regulated 6.2 volts shown in the diagram can be derived from a 12-volt source, both positive and negative, coupled through a 220-Ohm series resistor and a 1N4735A zener diode to ground, oriented for polarity. These elements were omitted from the diagram for simplicity's sake on the computer-generated schematic.

Speaking of computers, last month I mentioned a new group of computer accessories here at WA3AJR. This month, I would like to tell you about one of particular interest to the RTTY crowd. One of the biggest problems in writing RTTY software for the CoCo® is the "bit-banger" serial port. This is really one bit of a PIA, or parallel port, being addressed through a time-wasting loop so that it can put out one bit at a time. While this is flexible, we did a similar thing in a RTTY program written eight years ago; it does prevent the CPU from doing much else besides input and output. Enter the PBJ 2SP-PAK.

Containing a 6551 ACIA, this cartridge plugs into either the ROM socket or a CoCo expansion bus, such as the Tandy Multi-Pack or the PBJ C-C Bus (described last month), and provides two true serial ports. These ports are independently addressable under Basic, OS9, or any other program set up to address them and may be configured for baud rates of 50 to 19,200! Word length can be five—that's right, five—six, seven, or eight data bits, with all common parities. Not only that, but setting the word length to five bits enables a stop-bit setting of one and one-half stop bits. Now this would be about ten percent faster than "standard" Murray at 45.45 baud, but it may be worth a look. If you felt like potchkying, you could even put in your own clock to run at a nonstandard baud rate like 45.45!

When used with an expansion bus like the PBJ C-C Bus, the ports may be configured to generate interrupts, making the design of a sophisticated terminal program that much easier. It looks very hard to beat, and it adds another valuable dimension to the CoCo owner's station. For information, be sure to contact PBJ at PO Box 813, N. Bergen NJ 07047. Direct your inquiry to Al Alberto and tell him you want to know about the CoCo accessories described in "RTTY Loop."

You all have been a vocal lot when it comes to your preferences and the like with various computers on RTTY. This month it's the CoCo's turn. OK, owners of TRS-80 Color Computers, let me know what you are doing. What kind of software are you running on RTTY, how do you like it, and what else would you like to see? Put your information on a postcard or short note and send it to me at the above address.

For those of you who came in late, I am compiling this information for most of the popular computers, and when I have it all together it will be published here. Given the lead time of this column, I would expect that it will be early fall when I will give you all the final tally. Watch for it!

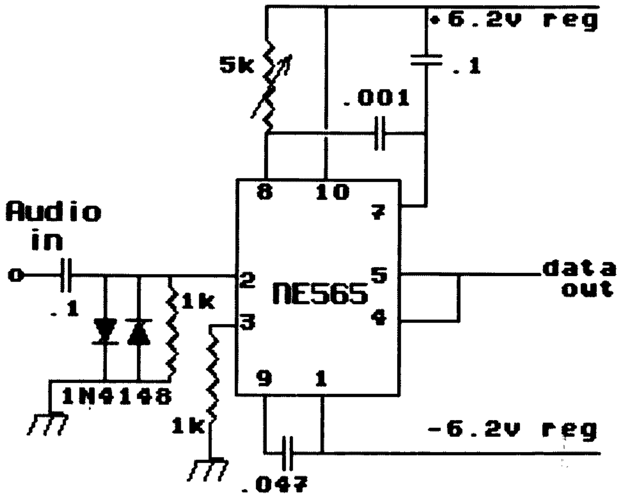


Fig. 1.

Controversy, controversy, I love controversy! Here's a little, generated by a letter from Henry Ross of Newton MA. Henry wrote to Heathkit when he noticed that their new HD-3006 RTTY Crossfire Tuning Indicator had its mark and space indicators reversed from what he had always assumed was a "standard" arrangement. To wit, the Heathkit unit displays a "cross" type of tuning pattern, with the mark signal as the vertical bar and the space as the horizontal. Henry states that he had always seen the mark as horizontal and space as vertical, and asks for a judgment.

Well, I consulted several references, since I was unaware of a standard myself. You know what? A RTTY handbook published twenty years ago does show the mark as the horizontal bar and the space as vertical, but another RTTY handbook from about ten years ago shows just the reverse, just like the Heathkit. So, sorry to fudge, but I guess you pay your money and take your choice. Whatever you grew up with, that's what is right. Sort of like cinnamon and sugar versus syrup on your french toast, I guess.

I am continuing to put together extracts, updates, and compilations of old columns. With eight years to draw from, I do have a lot of material to draw from. A list of what is currently available can be yours for an SASE mailed to the above address. Because of the lead time of this column, it would be foolish of me to try to list them all out here. Who knows, I might even get a burst of energy, or find some previously forgotten chunk of time, and churn a few more out. Anyway, let me hear from you if you are interested.

You know, every month I end the column with a note about dropping me a line on this or that, with an admonition to be sure to enclose an SASE if you would like a reply. Well, I know that postage is going up, and we're supposed to be on the way to becoming a paperless society, so if you like, you may send me E-Mail on Compuserve, and I will try to answer you when I get the message. Address it to me, with user number 75036,2501. And enjoy a little chuckle as my telephone bill climbs!

W2NSD/1
NEVER SAY DIE

editorial by Wayne Green

from page 4

hearing a weak station calling CQ in the DX part of the band. It was a W5 something portable. I felt foolish calling a station where I didn't know the call, so I made it short. He came right back, gaining in strength. I began to get more of the call—W5I... W5IMW portable... W5IMW portable C7 in Tiensin, China!

He was running ten Watts to a very long wire and I was the only station on the band. We talked for about fifteen minutes and then he said I was fading and other signals were coming through. An hour later he was calling me again—everyone else had faded out and I was still going strong.

That pattern repeated itself over and over. Often S9+ DX ops just couldn't hear me. If I'd get up a half hour earlier in the morning, they'd come right back with wonder at my signal into the south Pacific.

Alas, after I got out of college I got into broadcasting and lived in rooming houses and never had any space for Twin-Threes. Oh, I had a rig with me, but the best I could do was a twinlead dipole thrown into a nearby tree.

Not to write a discouraging word, but I think if you go to the trouble to build a Twin-Three antenna, you'll find it is useless except at the height of the sunspot cycle. Its angle of radiation is just too low to do anything these days.

The Twin-Three was invented by John Kraus W8JK, of course. It appeared in *CQ* in 1945. I published it again in the late 50s in *CQ*. I've probably published it in *73*, but it's long enough ago that I've lost track. Jones used to have it in his *Radio Handbook*. Don't worry, when the sunspots come back I'll give you the dimensions. I remember 'em.

You know, I've often wished I had a location where I could hang a 75m Twin-Three antenna. What a signal that might put out! Of course, you would have to find 40-foot-long support braces for the ends. It might take a four-by-four for that. What a beaut for a sweepstakes contest. That might work even in the low sunspot number times.

DX

Chod Harris VP2ML
Box 4881
Santa Rosa CA 95402

AMATEUR RADIO IN THE USSR

Politicians in the United States have deep-seated and important differences in opinion with their counterparts in the Union of Soviet Socialist Republics (USSR). From the relative importance of the individual versus the state, to what the other side claims is a conspiracy for world domination, it is hard to imagine two well-developed countries with so little common philosophical ground. However, the Russians have found that the many benefits of a domestic amateur radio service far outweigh the inherent conflict between the freedom of the individual and the power of the state.

Specifically, amateur radio provides a cadre of self-trained electronics and communications technicians at little or no cost to the state. Russian hams also provide some measure of international goodwill to their fatherland, another common ground with their sworn capitalist enemies.

But the Russians take a very different view of ham radio than do United States lawmakers. The concept of individual enterprise and initiative is discouraged in the USSR, in favor of benefits to the state. Somehow the Central Radio Club, administrator of RadioSport in the USSR, has managed to balance the apparently conflicting forces of central control and the uncontrollable, individual nature of amateur radio, to provide a healthy amateur radio service in their far-flung country.

In an effort to increase understanding between our two peoples, let's look at the amateur radio service in the USSR, and then perhaps share some of our amateur-radio experiences with our fellow hams behind the Iron Curtain.

Getting an amateur-radio license in Russia takes more planning and preparation than getting a US Novice license. The basic license application asks for considerably more information than that requested on the FCC Form 610. Statements about whether the applicant has ever traveled outside the USSR, details of any criminal convictions, and information about military service are only part of the application. A complete autobiography is another requirement, especially including details as to parents' nationalities, working habits, and whether or not the applicant or any close relative is a communist party member. A letter of reference from one's boss at work (or instructor at school) must also be included. Young (14–16 years old) aspiring hams need parental permission to apply for a ham license, with the parents affirming their responsibility for their children's actions. (My father never would have signed such a statement.) The applicant also must provide four photographs, a copy of his or her residence registration, and the schematic of the proposed receiver. That's right, a schematic of the radio. There aren't any Radio Shacks or amateur-radio stores in the USSR, and all amateurs are expected to build all their own gear from scratch. (It doesn't work out this way in practice, as some of the more technically inclined hams do much or all of the actual construction for some of the more on-the-air oriented amateurs, but the Central Radio Club does assume a much higher level of technical expertise than the FCC does.)

Once the application has been reviewed and approved, the amateur is allowed to begin—to receive only!

All this is required merely to get a Shortwave Listener's license. The SWL gets a "callsign" based on the republic of residence and the local radio club and starts to accumulate QSL cards. Every active DXer has received a handful of SWL cards from Russian and Eastern European would-be hams. And many stateside amateurs simply file them in the circular file. But these cards mean a great deal to the sender.

In order to move up to an operator's license, the budding ham has to SWL for a period of at least 6 months, and probably longer. He (or she) must accumulate about 500 QSL cards. Considering the terrible return rate of SWL reports, this is quite a chore. Fortunately, fellow Eastern Bloc amateurs survived that same requirement and are usually more responsive to the SWL request than stateside hams, who all too frequently treat SWL cards as a nuisance. For hams in several countries, however, these cards are an important stepping stone toward a full amateur license. Consider that before you toss that handful of Russian SWL cards in the trash.

Once our would-be amateur has amassed the appropriate number of QSL cards, he or she takes an oral examination and, if successful, gets a beginner's callsign. The new amateur has transmitting privileges on 80, 40, 15, and 10 meters, but at a power level of only about 25 Watts. Note that the Russian Novice does not have access to 20 meters, a restriction shared by stateside Novices. On the other hand, no knowledge of code is required for the entry-level license.

So now our new Russian amateur races to his or her own shack and starts sending "CQ DX?" Not quite yet. As in the US, the amateur needs both an operator's license *and* a station license to get on the air from an individual location (QTH). In the US, the two parts of the amateur license are on the same piece of paper, and the application for both is Form 610. The Russian amateur actually requires two permits to send: one to build the transmitter (remember: no Yaesus or Kenwoods in the USSR) and yet another permit to operate the transmitter! Both of these station permits must be renewed on an annual basis.

For those amateurs who cannot meet these requirements, or who cannot afford the cost of the transmitter or component parts, the local radio club probably has a club station.

Even with an individual station license in hand, our new Russian amateur is not yet prepared to talk to stateside amateurs. Working amateurs in capitalist countries such as the United States requires yet another permit. In addition to the formal application, the amateur wishing to expand his or her DX horizons to include capitalist hams needs to submit a copy of the station logbook, a list of contest activities, and confirmation of "social work," services rendered on behalf of the state.

Our budding amateur might also wish to upgrade the Novice license to a higher class. The next higher license class includes CW privileges on 20 meters, as well as on the other HF bands, but it does not include 20-meter phone privileges. The power limit is also higher: 75 Watts. The majority of Russian amateurs hold this class of license.

Certain amateurs hold the highest class Russian amateur license, which carries full privileges on all bands, all modes, with a 250-Watt power limit. (Some of the club stations approach this power limit the way too many stateside hams do—as a lower limit! Some Russian transmitters have 250-Watt driver stages, feeding final amplifiers which would make even a California Kilowatter green with envy.) Required qualifications include 2000 QSOs, activity in six contests in the past two years, 20-wpm code receiving and 18 sending (without error), and 8 amateur-radio awards earned. Obtaining this highest class of Russian license seems to require more than amateur-radio expertise. Good political connections or active social work appears to be a prerequisite for the unlimited class.

Whatever the class of license, the callsign of the Russian ham reveals valuable QTH information. Unlike the United States, where the number of the callsign is rapidly losing all significance, the callsigns in Russia are issued in a very orderly fashion and indicate the specific oblast (local political unit) of the operator. The first letter of all regular Russian callsigns is R or U. The E-block of callsigns is allocated to the USSR but is restricted to special-event callsigns. The second letter of the Russian callsign always indicates the republic of the operator. There are 15 separate republics in the Union of Soviet Socialist Republics, each with its own identifying second letter. For the most part these letters follow the prefixes used before the May, 1984, callsign reform in the USSR and can be found in any list of amateur countries. The callsign also differentiates club callsigns from those of individuals. And unlike stateside stations, a Russian ham gets a new callsign if he moves to a different oblast. (See the May, 1984, "DX" column for more details on the Russian callsign reform.)

Working the Russian Station

One of the major differences between amateur radio in the USSR and in the United States concerns freedom of speech. In this country there are essentially no restrictions on topics which can be discussed over the amateur airways. In fact, even amateurs who repeatedly use foul and obscene language cannot be easily driven off the air, as certain California repeater operators have discovered. The only topics actually prohibited on the amateur bands are those subjects which are crimes outside the field of amateur radio. For example, you are not allowed to plot a robbery over the local repeater.

Behind the Iron Curtain, freedom of speech has a vastly different meaning. The Russian amateur rules specify which topics *may* be discussed over the air, rather than listing those which cannot be discussed. Russian hams must limit their QSOs to comments about their individual stations and topics directly related to amateur radio. Comments about politics, religion, and other sensitive subjects are expressly prohibited. Asking a Russian ham if QSL cards are censored gets a reply such as, "Weather here very cold." The previously-excellent English of the Russian ham seems to deteriorate rapidly when topics other than amateur radio are broached. It is important to keep this restriction in perspective: What is remarkable is that Russian amateurs may converse at all. That the topics of conversation are restricted seems more in keeping with the highly centralized state.

Once you have made contact with a Russian amateur, you'll probably be looking for a QSL card. If you query the Russian amateur about a confirmation, he will probably respond, "QSL sure via Box 88, Moscow." In keeping with the centralized nature of amateur radio in the USSR, all QSLs must pass through Box 88, the QSL address of the Central Radio Club, just outside the city limits of Moscow. If you send a card to a Russian amateur, it must go to Box 88, where it is sorted and forwarded to the appropriate local amateur-radio club for distribution. Any prohibited items would be removed or detached at this time: money (green stamps), IRCs, religious tracts, political statements, indecent cards, etc. The Russian amateur returns your QSL in the same manner: via Box 88.

As with many other aspects of what is considered to be a hobby in this country, the Russian authorities take QSLing very seriously. The amateur who receives a QSL card is obligated to return the courtesy. Failure to respond to QSL requests is cause for loss of license. Can you imagine a similar rule in the United States?

Even with this seemingly rigid rule, getting a QSL card for a contact with a Russian amateur can try the patience of any amateur. For example, during sunspot peaks (alas, not now!) many of the low-power Soviet amateurs work around the world with their limited gear. The higher-class licensees work correspondingly more stations, greatly increasing the QSL load on Box 88. As the number of QSL cards passing through Box 88 doubles and triples, the sorters and forwarders fall further and further behind. As the sunspots start to fall off, the QSL bureau managers begin to catch up with the backlog of a year or more. Three years was the typical wait for Russian QSLs after the last sunspot maximum, with some notable and welcome exceptions. 18 months to two years is close to the norm for Russian confirmations today, but you may find quite prompt service during these days of fewer sunspots, and fewer QSOs.

Even when the turnaround time through Box 88 is relatively rapid, another snag slows the return of your confirmation. Russian cards for stateside hams are neatly bundled into brick-sized packages which cost the least to ship, via surface transportation, of course. But unlike just about any other country, the Russian QSL sorters do not send the cards directly to the appropriate incoming QSL bureau in the States. Instead, cards for every call area are mixed together. These bundles have to be broken apart and sorted by hand into the appropriate divisions, to be forwarded to your local QSL bureau. This additional sorting step adds a month or two to the already-long process of getting a Russian QSL card. On the other hand, the Russians must go though the lengthy process of QSLing via Box 88 for *all* their DX contacts; you only have to put up with this cumbersome system for a small fraction of your QSOs.

The Central Radio Club has recently eased the restrictions on direct QSLing by Russian amateurs. The Russian ham can include a QSL in an addressed, stamped, but unsealed envelope, to Box 88. There the card will be checked for any unauthorized enclosure, sealed, and mailed. Some Russian amateurs have even QSLed directly with stateside amateurs, but the process carries its risks. More than one Russian ham has lost his license for just such activities. Unless you're an expert in Soviet-American relations, stick to the slow, but safe, method of QSLing via Box 88.

Radio Contests in the USSR

The Russians take their radio contests very seriously. The very name of the Russian amateur service, RadioSport, suggests the competitive nature of amateur radio in Russia. Soviet stations are very

active in the All Asian Contest, the Radio-Sport in July (of course), and their own equivalent of a major DX test: the CQ-M contest in May of each year. CQ-M stands for CQ-Mir, which translates as CQ Peace. This 24-hour DX contest starts about 2100 UTC on the second Saturday in May (check contest listing in the amateur-radio press for this year's dates and times). Russian hams will send a signal report and obtest number, and you respond with signal report and serial number. Contacts with stations on another continent are worth three points, those with different countries in your continent are worth one. Contact your own country for multiplier credit only. Multipliers are countries worked per band. Entrants who send their logs to Box 88, Moscow, by July 1 will receive a badge signifying their participation in the contest. Russian entrants in the CQ-M contest are required to submit logs; failure to do so can result in loss of license. An interesting wrinkle to the contest: Only those multipliers backed up by logs are valid. If you work a bunch of rare countries, but they don't submit logs, your contacts do not count.

Contacts with Russian amateurs can also lead to some attractive awards. Russian "diplomas" or awards range from an easy Worked-All-Continents to some very difficult worked-all-oblasts awards. For more information on these awards, send a self-addressed, stamped envelope to *USSR TidBits*, Editor Tom Frenaye K1KI, Box 62, Unionville CT 06085. A subscription to *USSR Tidbits* is $6.00 for six issues. Thanks to Tom for much of the above information.

LETTERS

LIDS AND KIDS

Over the past months I have read several stories in different amateur-radio publications regarding the poor behavior some amateurs show on our bands. I have run into a few of these myself, but on February 11, 1985, I heard a QSO I will never forget.

I happened to be tuning the 75-meter phone band at about 3:00 pm EST when I came across two amateurs from the 1st call district conversing on 3780 kHz (they later moved up to 3810 kHz). For over an hour I listened to these two guys badmouth just about everyone from the government down to the paperboy. Foul language was the order of the day (I term any language not allowed on TV or radio as foul). Women were referred to as "broads" and just about everyone was an idiot, including a popular amateur-radio distributor in the Philadelphia area.

Of course, this QSO wasn't complete until it contained some racial slurs. But the climax came when they agreed that it was a shame that Reverend Jesse Jackson wasn't aboard his former campaign plane when it crashed. UNBELIEVABLE!

Where is the FCC when you really need them? It's no wonder that a certain other amateur would not answer their calls to join them. He knows how to select his friends! These two fellows called so many other people idiots when, in fact, what they needed was a mirror.

My point is this. How can we lure new blood into our ranks when people like this reflect such a poor image? All a newcomer has to do is tune to a QSO like this and he will think that amateur radio has less to offer than CB.

Finally, if we are to save our bands from commercial interests, we better show the FCC that we have a better need and use for our frequencies than these two lids did!

John R. Schell N3AB
New Tripoli PA

TOM TOMS

I love radio communication and I'm going to get my Novice license in a couple of weeks. I had to learn Morse code (why I don't know); I hate code and don't expect to use it.

I wonder why you like to keep the Morse code. As far as I'm concerned, the code is a thing of the past—it is the same thing that the Indians used to pass messages with on their tom toms. The code is out of time.

I know what you are going to say: If we got a license with no-code, the ham bands will be like the CB band. This is true.

Let me explain my beliefs. I'm not for a Novice license with voice privileges. Rather, I'm for a Novice test with tougher questions and no code requirement which grants you the privilege to use CW by computer.

One thing I would like to mention is that nobody seems to be concerned about the proliferation of Japanese products on the ham market. In my eyes, this is worse than the no-code license.

R. D'Amico
Dixon KY

Blessed if I know where you got the strange idea that I am now or ever have been an advocate of Morse code. I'm the one who has been fighting the whole idea the hardest.

There is no reason to believe that removing the code requirement is going to make our ham bands like CB. We still have a rather strong technical and rules exam, which should do the job. Japan has no-code and their ham bands are just fine.—Wayne.

CELLULAR DIVISION

You are no doubt aware of the recent proposal by General Electric to develop in the United States a "Personal Radio Service" (PRS) to provide ordinary citizens a workable alternative to the Citizens Radio Service and the vastly more expensive cellular radio-telephone. A similar, though surprisingly less versatile, system is already in operation in Japan and is evidently proving extremely popular.

As I understand GE's proposal, a type-accepted repeater with phone-patch capability would operate at a 900-MHz allocation, working with one or more mobile/portable units to provide radio-telephone capability. There being no proposed restriction on antenna height, one could erect as much aluminum in the air as the pocketbook (or zoning board!) would allow. The anticipated working radius would be in the neighborhood of 5–8 miles—fully sufficient for 80% of most individual needs. Frequency selection, signaling, and identification would be by digital means in a manner similar to cellular radio-telephone.

Predictably, this proposal has met strong opposition from corporate interests heavily vested in cellular radio-telephone that feel that PRS would threaten development of cellular radio. They state that once the cost of mobile hardware drops under $1,000 per unit, the market will "take off." This overlooks the cost of *using* cellular which, at present, is about $100 per month, far beyond the reach of most persons. PRS nicely fills this gap and could be a viable system with widespread acceptance *if* the cost can be kept in the neighborhood of $500 for both a home repeater and one mobile/portable unit. Absence of a monthly usage fee is another very favorable factor.

The whole situation says a lot about the corporate mind-set whereby new ideas are perceived as a threat rather than an opportunity. My personal feeling is that manufacturers should be considering how they might market such systems to make a healthy profit, as occurred in the heyday of both amateur radio and Citizens Radio. This would require them to rethink their role and recognize that they are in the business of selling *communications* rather than selling cellular-radio or CB *equipment*. The much-talked-about "under $1,000" cellular breakpoint is, in my opinion, not going to amount to much so long as the cost of use remains high, as it very likely will. Industry spokesmen who talk about cellular radio's broad acceptance and who are in decision-making positions simply do not have a realistic grasp of the fact that the average person must apportion carefully his/her limited funds. These corporate decision-makers are not "average citizens," don't earn average salaries, and, therefore, almost inevitably make the wrong determination as to how the ordinary citizen will act! But I am straying from the point.

I wrote to Senator Goldwater stating that corporate opposition might, in the interest of the citizenry in general, be circumvented by a grass-roots program coupled with *visible, active* support from within government. I hope that he may be able to generate some interest and support.

There is another aspect to this issue which may work in its favor. So far as I can determine, PRS would be an "American" system: developed, marketed, and (at least partially) manufactured by an old-line US firm, General Electric. It is time that a technologically up-to-date product was marketed by a US firm!

We hear much of the so-called US technological edge but, in fact, this is not all there is to the issue. While we seem able to develop new concepts, it is in the areas of manufacturing, marketing, and getting the practical result of those ideas in the hands of users that we fall woefully short. Many new products conceived on these shores have been put into service and have reached maturity in Japan and Europe while languishing in endless litigation in the United States.

This communications era should encompass all citizens, not just those with technical credentials, corporate backing, or large amounts of money! PRS addresses a genuine need and, I believe, would in no way dilute the growth of cellular radio or radio common-carrier services. It is time we had a workable alternative to the obsolescent, interference-plagued Citizens Radio Service. In my opinion, GE was wrong to withdraw its proposal in face of corporate opposition. Don't we believe in competitive free enterprise, or do we merely pay it lip service? It is up to farsighted, influential individuals and organizations to make this issue visible in a meaningful way to the public so that we can eventually adopt the service proven so successful in Japan.

Thomas L. Stewart K9LJQ
Champaign IL

DEAR JON

This is in reference to Jon Danford's (KA0SOV) comments under the heading "No Encouragement" that appeared in the March, 1985, issue of *73*.

I would like to state that the local ham club, with its seventy-plus membership, is a very diverse and talented group. It includes technicians, operators, antenna builders, experimenters, DXers, computer enthusiasts and, most important of all, the club is into emergency communications in a big way with its emergency-operations center operated in conjunction with the city civil-defense director. If it has to do with hamming, this club has it!

One must be approachable and step forward and seek out those in the club with his or her interests. It is there for the asking, and had Jon sought out help it would have been freely given. In fact, Doyle (W0SOM), who helped Jon, is a highly regarded member of the local club. If Jon had only discussed his feelings with the club president, his wishes would have been brought before the club. I can assure him he would then have received more help and encouragement than he could have used.

Our current president is a retired broadcast engineer and is a builder and experimenter. The local club abounds with hams who help, encourage, and support new hams and those who want to become hams in any way possible.

When election time rolls around again, I would encourage Jon to step forward with his new-found knowledge and ability and seek office. The club is always seeking new leaders. It is much easier to tear down a club than build it!

Jay C. Lowe KA0RKR
Joplin MO

(SIC)

After reading your "Never Say Die" and "Letters" colloms. I have found your magazine a complete insult to amateur radio. And will not buy or read your trash. Any-one who is for allowing no code test should be sent straght to 11 meters for life.

Then you go on to say at each renewal time, up the code requirement 5 wpm. (URS should be 20 untill fale)

Old indian say, white man you got fork tongue.

And by the way I am on the radio myself. And the code is a real dog wermier for me, but, it keeps the riff-raff out, and on 11 meters. You might fool the new hams but once they read for awhile they will catch on.

Hope to see you go broke

p.s. Bet you don't have the brass [*deleted*] to print this, do ya!!!!

J. Bowen KB6DXN

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

INDIANA MONTH OF MAY CONTEST
Starts: 0000 UTC May 1
Ends: 2400 UTC May 31

The objective is to be the first non-Indiana station to work 500 Indiana contacts, or the Indiana station reporting the most contacts. Stations may be worked once per band per mode. No crossmode, 30-meter, or repeater contacts are allowed. All entries must be single operator only.

This is a fun event designed to promote contacts between Indiana hams and the rest of the world. The contest is being sponsored by the Southern Indiana QRP Group to promote and encourage HF operation in Indiana.

EXCHANGE:

RS(T), name, and state, province, country, or IN county.

AWARDS:

Certificates to the top 33 non-IN and top 33 IN stations. Endorsements for all SSB, CW, QRP (5 Watts or less PEP), and others if warranted by entries received. Special certificate to any station working all 92 IN counties; any IN station achieving WAS, WAC, DXCC; and any Novice/Technician station reporting 33 or more CW contacts. Certificates will be awarded to the 33 non-IN stations reporting the most QSOs with IN stations if less than 33 entries reporting 500 contacts are received. Date and time (UTC) of last contact will be used to break ties.

ENTRIES:

Send copy of log, dupe sheet (200 or more QSOs), and score sheet. Business-size SASE for return mailing of results/certificates appreciated. Logs must be received by June 30. Official score sheet (optional) and IN county award checklist available for SASE. All logs and inquiries should be addressed to: Russ Ryle N9DHX, Southern Indiana QRP Group, PO Box 2466, Bloomington IN 47402.

FLORIDA QSO PARTY
1400 to 1900 UTC May 4
0001 to 0500 UTC May 5
1500 to 2300 UTC May 5

This is the 19th annual Florida QSO Party sponsored by *Florida Skip*. All amateur bands may be used, 160 through 2 meters. All stations will separate phone and CW logs; phone and CW are separate contests. A station may be worked once on each band on each mode. Neither crossband nor crossmode contacts will count for contest credit. Florida stations may work other Florida stations for contest points only. Out-of-state stations may not work each other for contest credit. Contacts made on repeaters do not count for credit.

Florida stations will be divided into two classes. Class-A stations are those operating portable or mobile on emergency power and running 100 Watts or less output inside Florida but outside of their home counties. Class-B stations are all other stations operating in Florida. Entrants may be single operator or multi-operator and this must be indicated on the summary sheet.

Each entrant agrees to be bound by the provisions of the contest announcement, the regulations of the applicable licensing authority, and the decisions of the *Florida Skip* Contest Committee, which are final.

EXCHANGE:

Florida stations send RS(T) and county of operation. Others send RS(T) and US state, Canadian province, or country.

FREQUENCIES:

Phone—3945, 7279, 14279, 21379, 28579, 50.2, 146.52. CW—3555, 7055, 14055, 21055, 28055.

SCORING:

Florida stations count one point per QSO with out-of-state or other Florida stations. Multiplier is the sum of states (49 max.), provinces (12 max.), and DX countries (27 max.) actually worked; maximum multiplier is 88. Others count 2 points per QSO with each Florida station. Multiplier is the number of different Florida counties worked (67 max.). Final score is the product of QSO points and the multiplier. Class-A stations *only*, multiply score by 1.5 to obtain final total.

AWARDS:

Certificates for phone and CW to the top single-operator contestant in each state, province, DX country, and each Florida county. Multi-operator winners will receive certificates as activity justifies. There are also 5 plaques to be awarded as follows: high single operator in Florida and out-of-state, CW and phone, and to the Florida club with the highest aggregate score. This year there is no minimum number of contacts to be eligible for a certificate.

ENTRIES:

Phone and CW entries are to be *separated!* Along with legible logs in chronological order, a summary sheet is required with each entry. The summary sheet must contain score, number of QSOs, multiplier, station callsign, entry class and number of Florida counties, power source for Class-A entries, county, state, province, country or region of operation, callsigns of all operators/loggers if multi-op, name of club if part of a club aggregate score, name and address typed or printed in block letters, and a signed declaration that all rules and regulations have been observed. All stations making more than 200 QSOs must also include a dupe sheet. Sample summary and log sheets are available for an SASE from the QTH below.

At the discretion of the contest committee, stations and/or operators may be disqualified for improper reporting, excessive dupes, errors in multiplier lists, unreadable logs, obvious cheating, etc. All entries must be received on or before June 3. Mail all entries to: *Florida Skip* Contest Committee, c/o North Florida Amateur Radio Society, PO Box 9673, Jacksonville FL 32208.

G-QRP-CLUB LATE SPRING QRP SSB ACTIVITY WEEKEND
0900 to 2300 UTC May 4 and 5

All radio amateurs interested in QRP are invited to take part in the club's activity. No special exchange information was mentioned in the information provided by the club. The operating schedule for each day is as follows: 0900-1100 UTC = 14285/21285/28885, 1100-1300 = 3690/7090, 1300-1700 = 14285/21285/28885, 1700-1900 = 3690/7090, 1900-2100 = 14285, 2100-2300 = 3690/7090.

Reports on the activity or requests for membership details should be sent to Fred Garratt G4HOM, 47 Tilshead Close, Druids Heath, Birmingham, B14 5LT, England.

In addition to special activity periods, members of the G-QRP-CLUB have a weekly activity period on Sundays between 1100 and 1230 and again from 1400 to 1530 on the international QRP frequencies, and on Wednesdays on 3560 CW from 2000 local time (UK and Western Europe).

MICHIGAN QSO PARTY
1800 UTC May 16 to 0300 UTC May 19
1100 UTC May 19 to 0200 UTC May 20

This year's QSO party will be sponsored by the Oak Park ARC. Phone and CW are combined into one contest. Michigan stations can work Michigan counties for multipliers. A station may be contacted once on each band/mode. Portable/mobiles may be counted as new contacts each time they change counties.

EXCHANGE:

RS(T), QSO number, QTH as state, country, or Michigan county.

FREQUENCIES:

Phone—1815, 3905, 7280, 14280, 21380, 28580. CW—1810, 3540, 3725, 7035, 7125, 14035, 21035, 21125, 28035, 28125. VHF—50.125, 145.025, 146.52.

SCORING:

Multipliers are counted only once. Michigan stations score 1 point per phone QSO, 2 points per CW QSO, and multiply QSO points by the total number of states, countries, and Michigan counties. KL7 and KH6 count as states; VE counts as a country. Maximum multiplier is 85.

Others, take QSO points times the total number of Michigan counties. QSO points are 1 point per phone QSO, 2 points per CW QSO, and 5 points for each club-station contact with W8MB. Maximum multiplier is 83.

VHF-only entries: same as above except multipliers per VHF band are added to-

CALENDAR

May 1-31	Indiana Month of May Contest
May 4-5	Florida QSO Party
May 4-5	Late Spring QRP SSB Activity Weekend
May 18-20	Michigan QSO Party
May 28-29	CLARA Ac/Dc Mystery Contest
Jun 8-9	Worldwide South America CW Contest
Jun 8-9	ARRL VHF QSO Party
Jun 22-23	ARRL Field Day
Jul 1	CARF Canada Day Contest
Jul 13-14	IARU Radiosport Championship
Jul 20-22	CQ VHF WPX Contest
Aug 3-4	ARRL UHF Contest
Aug 17-18	New Jersey QSO Party
Aug 17-18	SARTG Worldwide RTTY Contest
Sep 14-15	ARRL VHF QSO Party
Sep 14-18	Washington QSO Party
Sep 28-29	Late Summer QRP CW Activity Weekend
Oct 5-6	ARRL QSO Party—CW
Oct 12-13	Rio CW DX Contest
Oct 12-13	ARRL QSO Party—Phone
Oct 19-20	ARRL Simulated Emergency Test
Nov 2-3	ARRL Sweepstakes—CW
Nov 16-17	ARRL Sweepstakes—Phone
Dec 7-8	ARRL 160-Meter Contest
Dec 14-15	ARRL 10-Meter Contest

THE BIRMINGHAM

NEWSLETTER OF THE MONTH

One of the most professional newsletters we have seen in a long time is the *BirmingHAM*, from the Birmingham Amateur Radio Club. It looks like a tiny magazine. In fact, the staff is large enough to support a full-sized publication! Along with Editor Fay Burt KA4VIK, the masthead lists seven columnists, one photographer, and several editorial assistants.

The result of all this input is an incredible wealth of information packed into each issue. And the photos—the last issue had *thirty!* But the *BirmingHAM* is not just a bunch of pretty pictures. Fay blends everything together to create a consistently informative journal. To Fay, the staff, and the 401 members of BARC, we extend our congratulations.

To enter your club's newsletter in *73*'s Newsletter of the Month Contest, send it to *73*, 80 Pine Street, Peterborough NH 03458, Attn: Newsletter of the Month.

gether for total multiplier. No repeater contacts are allowed.

AWARDS:

Plaques to Michigan entries with high multi-operator/single-transmitter score, high Michigan score, high Michigan (Upper Peninsula) score, high aggregate club score, high VHF-only (100 QSOs minimum), high mobile, and high out-of-state. Certificates to high score in each county with a minimum of 50 QSOs. Out-of-state certificates for high score in each state and country.

ENTRIES:

A log and summary sheet are requested showing the scoring and other pertinent information, name and address in block letters, and a signed declaration that all rules and regulations have been observed. Michigan stations include club name for combined club score. Party contacts do not count toward the Michigan Achievement Award unless one fact about Michigan is communicated. Members of the Michigan Week QSO Party Committee are not eligible for individual awards. Decisions of the contest committee are final. Results will be final on July 30 and will be mailed to all entries. Mailing deadline is July 1. Mail entries to: Mark Shaw K8ED, 3810 Woodman, Troy MI 48084.

MICHIGAN ACHIEVEMENT AWARD

This will be the 27th year that hams have had their own program to publicize Michigan and its products. Just as for the past years, the Governor will award Achievement Certificates to hams who take part in telling the world of Michigan's unlimited resources, opportunities, and advantages. Certificates are awarded on the following basis:

1. A Michigan ham submits log information and names and addresses (if possible) of 15 or more contacts made to out-of-state or DX hams with information regarding Michigan.

2. An out-of-state ham, including any Canadian, submits log information and names and addresses (if possible) of at least 5 Michigan hams who relate facts to him about Michigan.

3. A foreign ham, excluding any resident of Canada, submits the call letters and name/address plus log information for at least one Michigan ham who has told him about Michigan.

Only QSOs made during Michigan Week, May 18-25, will be considered valid. All applications for certificates must be postmarked by July 1 and mailed to Governor James Blanchard, Lansing MI 48902.

CLARA AC/DC MYSTERY CONTEST

Starts: 0000 UTC May 28
Ends: 0000 UTC May 29

The contest is open to all YL and OM amateurs as well as SWLs. Each CLARA station may be worked twice, once on CW and once on phone, or same mode on two different bands. All contacts must be made in accordance with operator and station license regulations. No net or list operations, no crossmode contacts, no 10- or 2-meter repeater contacts. Three unidentified "mystery" stations will be operating during the contest.

EXCHANGE:

Name, serial number starting with 001, RS(T), OTH, and whether or not a CLARA member.

FREQUENCIES:

Phone—3775, 3900, 7150, 14160, 14280, 21300, 28488, 28588. CW—3690, 7035, 14035, 21035, 28035.

SCORING:

For the base score, CLARA members score 1 point per contact with nonmembers (whether OM or YL), 2 points per contact with CLARA members, and 3 points for each CW contact. Nonmembers score 2 points for each CLARA contact, 3 points for CW contacts. All multiply the base score by the number of Canadian provinces/territories worked for the total score. The contest manager will add 10 points to the base score of each log for every "mystery" station contacted.

AWARDS:

CLARA members are eligible for the 1st-place CLARA Cup and certificate or the 2nd-place certificate. Nonmembers will receive a plaque for 1st place, and certificates for 2nd place, 1st SWL, and 1st DX. All logs submitted are eligible for the mini prize drawing as well.

ENTRIES:

A single log entry must show date/time (UTC), band, mode, callsign worked, report and serial number sent, report and serial number received, name of operator of station worked, QTH, and points claimed. Logs must be signed and show full name, callsign and address of operator, and final score (points claimed not including mystery stations). Logs must be legible, no carbon copies, and no logs will be returned. Decisions of the contest manager will be final. Logs must be received by the contest manager before July 15. Address entries to: Muriel Foisy VE7LQH, RR#1, Pender Island, BC, Canada V0N 2M0.

BE MY GUEST

Guest Editorial by Edward Kessler WD4MJF/9

WAXING PHILOSOPHIC

Of all the many exciting, exotic, and enjoyable aspects of amateur radio, the most satisfying of all may very well be philosophy. An incongruity, you say? Perhaps, but bear with me for a few minutes and think about it as I explain.

My recent change of careers has given me the latitude to pause and reflect upon amateur radio not only as a technical hobby and public service, which it certainly is, but as a social mechanism which needs maintenance every bit as much as the equipment the hobby requires. Why did any of us pursue this hobby in the first place? To communicate, yes, but I submit that most of us, particularly those licensed since about 1960, chose amateur radio because we simply wanted not to be left out. We needed to participate in the conversations we heard on the air. Whether it was CW or AM made no difference. We felt left out. Many of us were SWLs of varying degrees of seriousness. This of course made us feel more intimately a part of a much larger and more interdependent world. Broadening our horizons, expanding our interests, and making us into international citizens is what amateur radio has always been able to do most easily, if we let it happen. The problem is how to make it happen.

Whether it be technological, social, or economic progress, in one way or another our fellow hams have always been in the vanguard. We have in recent years become stagnant in terms of social or economic usefulness. Rarely do we seem to be in the forefront of new technological breakthroughs or on the cutting edge of vital social issues. This is not to say we cannot once more regain the vibrancy which the hobby held in the past. We have only to regain the technical expertise and conversational ability that seems to have deteriorated over the last twenty years or so.

The pessimists believe that the operators who rant, rave, swear, and jam outnumber the rest of us. A casual listener on most bands would hear discussions of this sort of behavior and think the worst. What we must remember is that the ten to twenty folks doing the discussing are probably referring to one episode or person. It is, however, unfortunate that even a single episode should occur. From listening to some older hams, one would think that this type of behavior is a relatively recent phenomenon. We know better! I distinctly remember, as a listener in 1962, a W9 and W1 on 75 phone explaining how all of our problems were caused by Jews, blacks, Catholics, Kennedy, the Post Office, and God only knows who else. While I did not care for their philosophy, it stirred me enough to want my ticket. I did *not* want to be left out again. The good old days were never any better than they are now in this respect.

So, before we decide that the world and amateur radio are going to hell in a hurry, let's adopt a philosophy of finding something good in our fellow hams and striving to emulate them.

For instance, do contests just burn you up? Are you one of the group that complains about the wasted spectrum and time? Or are you envious of the operators who buy the megabuck station in order to participate in contests? It really makes no difference. The contests will be there, like them or not. You may as well try one. Not for the score, but as a courtesy to the operators who are in it for the sport and the score. I had heard for many years of the perfunctory nature of the contest QSO. While admittedly they are very brief (it is a contest), they *can* be very friendly. Participating in the 1985 World SSB Championship on both 40 and 75 meters, I was pleasantly surprised by the courtesy of VE3DDK, WA6PVA, WB7FDQ, KB0C, and VE3ICR, to name but a few. Thanks, guys. My sixty Watts and trap vertical made it difficult for you, but you stayed with me, probably losing several other contacts.

Are you tired of hearing the virtues of CW? Personally, it turns me off. Having been off the air for a couple years, I returned to the Novice portion of 40 meters recently. The reason was simple: Novices still have that sparkle in their eyes that we all have had at one time or other. Things there haven't changed, thank goodness. I met Nancy KA2VNM, who hung in there with me through the QRM and my rusty fist for the better part of 45 minutes. A *very* enjoyable contact and conversation. Thanks, gal.

We hear about hams not taking an interest in newcomers or would-be hams. Yes, I know all about the excuses. I have used some myself. But others manage to find time. Witness KC0GF, AJ0A, WB0MST, and spouse WB0MSU. Denis, Ken, Carol, Fritz, and the many other hams in Grand Island, Nebraska, not only give regularly scheduled classes for would-be hams, they practically ensure the students' success with their attention, courtesy, and friendship. Thanks to all of you.

Perhaps you cannot do something like this on such a scale. Then get involved with your local schools. Many hams now are older and do not have children in school. That is no excuse. We still pay taxes to support our public schools. If you aren't involved, you simply have no right to complain about the quality of education young people are getting! So let us make a concerted effort to be involved in the educational process of the youth in each of our communities.

Several years ago I read one of Wayne Green's editorials about topical CQs. I can probably count the number I have heard on one hand and still have fingers to type this. I know there are many hams in the military who have a diverse range of interests. There are many in various agencies of the government who are performing interesting and vital work which we would love to hear discussed. Businessmen and teachers, *surely* the topics of rigs and dipoles are incredibly boring after a few QSOs. Many of us are more than casual observers of international relations, if only because of DXing or broadcast QRM. We are better informed because of our hobby. What better place to discuss foreign affairs, banking, trade relations, and public opinion than on the ham bands? This may be the only way many of us can contribute to better understanding and coexistence with other nations and cultures. We are in an ideal position.

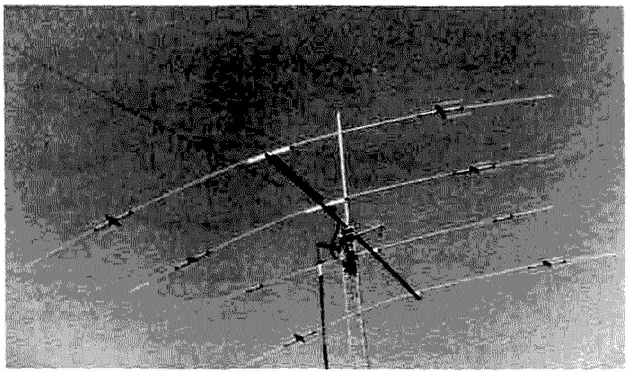
While we are talking about topical QSOs and CQs, I must comment that, unfortunately, the only one I have heard in the past three months was from a WA4 who insisted on using a reverberation unit while telling listeners those who would not be acknowledged. His expressed concern for the future of amateur radio and working young people is appreciated. However, there is still a place in our hobby for courtesy, tact, the zest for life, and the eagerness to meet and talk with new friends shown by the kids at school club station WB3BTD. Thanks, Teddy and Kristy. Hope to hear you on again soon.

Many of us remember hearing that we should not discuss politics, religion, or sex on the air. Times have obviously changed! These are subjects which are important in our society and to ignore them would be to ignore a most opportune way to open up other avenues of discussion. Obviously, a little caution is in order. I certainly do not expect to hear, "CQ,CQ,CQ, CQ sex therapy, CQ sex therapy, this is WD4###." I don't think I could explain to the in-laws! If you have a problem, see a doctor.

Do I have an axe to grind? Sure! I grow weary of the negative attitudes of many hams, the pessimists who say they are pragmatists and that nothing can be changed. They are correct unless we all adopt a philosophy of optimism. The goal should be to get each other to say, "Yes," or, "Maybe," or "Gee, I never thought about it that way."

Amateur radio is a philosopher's paradise. It can be a force again for social and economic advancement. We are the ones who must make it work. There is room at the top for all of us. All it may take is some regenerative feedback into the hobby to once again make that friendly force radiate.

REVIEW



The TET HB 443 DX.

TET HB 443 DX

I have some good news for you DXers and 40-meter operators. There's a new kid on the block who's here to answer your small-lot prayers. It's the TET HB 443 DX, and TET's OX suffix is no exaggeration. This four-element antenna has full band coverage on 10, 15, and 20 meters, and 50 kHz of bandwidth (under 2.0:1 swr) on the 40-meter band.

The antenna weighs in at a mere 39 lbs. (18 kg.). Boom length is 19.8 ft. (8 meters). Maximum element length is 30 ft. (9 meters). The antenna is capable of over 1 kilowatt of power and utilizes an air-core balun.

TET advertises gain factors over a half-wave dipole of 6.8 dB for 10 meters, 9.1 dB for 15 meters, 9.8 dB for 20 meters, and a healthy 5.2 dB for 40 meters. Front-to-back ratios fall in around 21.5 for 10, 15, and 20 meters. A 12.4 front-to-back ratio is listed for 40 meters.

The antenna is shipped in two 6-foot boxes to allow for UPS delivery. After unpacking all the pieces from both boxes, I uncovered the instruction manual. In my opinion, the instruction manual is the only flaw that the antenna has. It contains six pages of drawings with all dimensions in millimeters. The manual has no written material, so if you have any questions, don't bother to search through it for written instructions. This left me rather dumbfounded, because usually you are at least given some information on the adjustments for obtaining a low swr.

Relax, though—all my questions were answered once the antenna was assembled and erected. Seems the Japanese have taken all things into consideration and have done everything but send along a trained chimp to assemble it for us. All pieces are clearly labeled by the factory to ease the assembly. All element sections are pre-measured and pre-drilled. The only measurement which I had to make was for element placement on the boom.

TET also allows you to select which portion of 40 meters you wish to operate: CW, DX phone, or US phone. The US phone portion of 40 meters which TET has pre-drilled for is the Advanced portion of the band. I found it necessary to drill two new 1/8-inch holes. Each hole was made exactly 1 inch from the original phone-band holes to allow the antenna to be resonant on the General portion of the 40-meter band. This modification was only done on the driven element; you need not touch the reflector. You Generals may want to make this modification before erecting the antenna high atop a tower.

The entire antenna took me a total of 1 hour and 50 minutes to complete. Note: Be sure all ventilation holes on the traps face downward—this is important.

After erecting the antenna on top of my tower, I cranked the tower up to a height of 50 feet and went into the shack to check out the results for each band on the swr meter. Fig. 1 shows the frequencies and swr readings that were recorded without making any changes to the antenna.

Next was the real test: on-the-air reports. The first station worked was a YO2 in Romania. My report was 20 over S9. Not bad for running only 100 Watts output. I then worked a OF, an OE, and an OK, all of whom gave me 5 and 9 reports. I was really surprised to get those reports, even on 20 meters from a trapped yagi.

For three months now I've been working 10, 15, 20, and 40 meters with the antenna. Station EL1F reported 5 and 8 on 15 meters and station LU4MDR reported 5 and 9, to mention just a couple of the many OX contacts which I've made, all using 100 Watts PEP output. Since the antenna was erected, I have worked 79 new countries.

Now for the information you're all waiting to hear: How well does the antenna perform on 40 meters? Well, I can say this: If you have a full-size 3-element beam for 40 meters which is rotatable, I'm sure that it would outperform the HB 443 DX on 40 meters. But, if you're like most of us who are struggling with dipoles, inverted vees, and delta loops, then this antenna might be what you're looking for.

I made all comparison tests against an inverted vee with its apex at 60 feet and a half-wave dipole at 50 feet (while operating on the 40-meter phone band). The TET antenna is mounted on a 52-foot tower. All contacts were made stateside. In every instance the HB 443 DX gave me 2 to 3 S-units higher signal than the dipole or the inverted vee. In many cases I could not even hear the stations when I switched over to the dipole or the inverted vee. I might add that the TET antenna did a good job of nulling down the broadcast station noise on the band when turned away from the source.

So, to wrap it all up, in my opinion TET has really got a super antenna here that is going to start turning some heads. If the HB 443 DX is still a bit big for you, then you might take a look at its little brother; the HB 433 DX. It's a 3-element, four bander on a 13-foot boom, weighing around 30 lbs.

I hope that the preceding article has been helpful and has answered some of the questions you may have had about the HB 443 DX. At least it will let some of you know that a new antenna for 10 through 40 meters is here. Good DXing and see you on the bands.

For further information, contact *Lunar Electronics, 2775 Kurtz Street, Suite 11, San Diego CA 92110-3170; (619)-299-9740.*

Robert Matthews KA3JOM
Baltimore MD

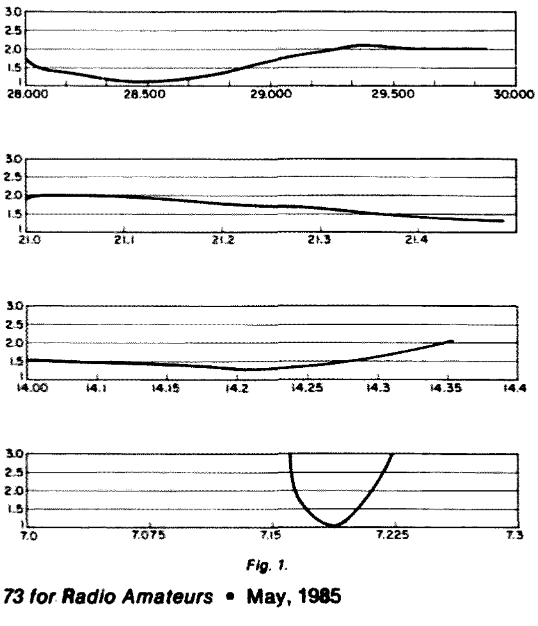


Fig. 1.

SSD-16010-C NINE-BAND SPACE SAVER DIPOLE

Until fairly recently, I had a very convenient QTH for antennas. My backyard easily accommodated various dipoles as well as a 300-foot longwire. The oak trees provided very solid and dependable supports for my experiments with loops, deltas, and verticals. However, as the size of my family increased, the house became too crowded and we ended up making a move to a larger house on a (sadly) smaller lot. Good-bye, antenna farm—my new quarter acre was never intended for such luxuries. What to do?

I came across an ad for the W9INN nine-band Space Saver Dipole ($85.00) and found the solution to my particular problem. It may work for others as well. This antenna is a compromise. After all, a 46-foot-long dipole cannot be expected to work quite as well as a half-wave antenna, but the results are more than satisfactory.

The SSD-16010C is designed to cover 160 through 10 meters (including the 30-, 17-, and 12-meter bands). There are two parallel elements separated by four spreaders. One pair of elements covers 80, 30, and 20 meters, while the others cover the remaining bands. A wide-range antenna tuner is required (my ultimate transmatch works fine) and you can order the antenna in either coax or ladder-line versions. There is a very solid center insulator (the Unadilla W2AU "Ansulator").

The antenna operates as a dipole on all bands except 160, where it is used as a Marconi. A feedline of at least 40 feet is required for operation on the Top Band. The Space Saver Dipole has no traps: Instead, four inductors are used. The antenna will run full legal power on all bands and can be used as a dipole, inverted vee, or sloper. You can fold the elements and reduce the overall size to only 30 feet, making the Space Saver Dipole a candidate for installation in the attic. The antenna comes fully assembled except for the spreaders, which can be installed in minutes. The elements, coils, and hardware (stainless) are all very good quality and should last very well under the most hostile environments.

I managed to run a line over an oak tree branch at the 40-foot level (lucky throw) and hauled the Space Saver Dipole into place as an inverted vee. It has worked very well on all bands from 80 through 10 meters (I don't operate 160 meters right now). The results are down from those encountered using a full-size dipole at a comparable height at the old QTH, but I am satisfied with the results. As a casual operator on phone and CW, I use a variety of bands and try to operate at off-peak hours. This may very well contribute to the other stations' ability to hear me.

Overall, the Space Saver Dipole is a very worthwhile investment for anyone who has limited space and must compromise on the antenna system. It is very well made and is reasonably priced. I have recommended it to several people on the local repeater who have similarly small lots. This antenna provides a large coverage in a small package.

For further information, contact *W9INN Antennas, PO Box 393, Mt. Prospect IL 60056.*

Thomas Mart AD1B
Dedham MA

COMPUTER PROGRAMS FOR AMATEUR RADIO

There are an awful lot of microcomputers finding their way into ham shacks these days. There are almost as many bewildered hobbyists hungry for information about bow to make their new computer do some of the amazing things they have read it can do. *Computer Programs for Amateur Radio*, written by Wayne Overbeck N6NB and James Steffan KC6A, helps to fill in the information gap.

Sitting in the bookstore, the book is physically impressive, running well over 300 pages in length. It promises "high-performance programs written in Basic for your Apple, TRS 80, or Commodore 64, plus conversion guides for the IBM PC." As it turns out, it delivers programs for not only these machines, but any machine capable of running CP/M and even some that will run on the Timex/Sinclair and the VIC-

20. Keep in mind, however, that many of the most impressive programs require a machine expanded to 48K of memory or more.

Trying to gauge the audience for a book can be difficult. If you start at too elementary a level, more experienced readers are put off. Start too deep, and very few will understand what you are saying.

I would judge this effort as being aimed at mainly the newcomer to using computers. The first five chapters of the book are an overview and history of the home computer. They are well written. While interesting and informative, they will not tell you everything you ever wanted to know about home computers. If you have been computing for a while, I doubt you will learn anything new here.

My main reason for buying the book was to get the programs it contains, and there are a lot of them. In computer terms, many of the programs are "data base managers," that is, they aid in storing and retrieving information. Several others are calculation aids for scaling antennas, figuring actual power at the antenna, moon tracking, EME calculations, and so on.

There are no CW or RTTY send and receive programs, no slow-scan television programs, and, in fact, no hardware interfacing programs of any kind. The authors indicate that this is to avoid "needless duplication" of existing programs.

It would be difficult to write programs that are transportable enough to run on many computers and address the special hardware interfacing requirements of each machine.

Here's a list of what's included: Logbook, Radio Awards Data Base, Grid Locator, Worldwide "Catalog File," Sunrise Chart, Sunrise Calculator, Grayline, Beam-heading Chart, DX Display, DX Checker, Dupe Checker, Dupe Print, Contest Logger, Generalized Logger, Field Day Logger, Sweepstakes Logger, Log Print, Antenna Scaler, Antenna Evaluator, Phased Vertical Pattern Plotter, EME System Analyzer, Moontracker, and Skylocator.

This is indeed a good variety of non-hardware-type programs, and they all work! In the Commodore programs I found only one error of sorts. In Commodore Basic, to raise a number to a power, you use an "up arrow." In the book this is denoted as an up caret. I guess the typesetter ran out of arrows after the last book on vectors was published.

Additionally, in the book all of the printer routines for the Commodore programs are set up for RS-232 printers. I think I am one of the few people in the world who have Commodore computers feeding an RS-232 printer. To the authors' credit, the correction sheet and the disk take this into account and set up the programs with the more standard Commodore device #4.

Several programs are really variations on the same theme. For example, the DX Display and Beamchart programs both use the massive latitude and longitude file, as do several of the other programs. The logbook and contest programs are all built on similar programs.

Some of the programs have been around in the public domain for some time. It is still impressive though to watch your $200 computer produce moon-tracking printouts or provide you with sunrise and sunset times for a bunch of cities around the world on any given day.

The antenna-matching program may yield a surprise about what kind of power you actually have at your antenna, and the EME program is certain to make you yearn for a country estate on which to reenact the Arecibo dish!

The programs all work as advertised, though in some instances the screen display doesn't look very good. I did not find that problem with the printouts produced by the programs.

If you are like me, you like typing programs in from a book or magazine almost as much as you enjoy a good root canal on a sunny day. A prepared disk is available for most computers for an additional fee. I was certainly glad I ordered that for my Commodore 64. Otherwise, I think the book would still be sitting on the shelf with very few of the programs actually typed in.

As you contemplate taking home this 300-page book, keep in mind that only a fraction of those pages will contain information for your particular computer. Expect to do a lot of typing without the advantage of an error-checking program. I strongly recommend the disk to go with the book, which almost doubles the cost.

Computer Programs for Amateur Radio can serve as a jumping-off point for the new computer owner. It would make a good addition to a club library.

Computer Programs for Amateur Radio is available for $16.95 from *Hayden Book Company, Hasbrouck Heights, New Jersey.* Your local bookstore may also have it or can order it by requesting ISBN 0-8104-0657-8. The disk is an additional $13.00.

Jim Grubbs K9EI
Springfield IL

THE COLATCHCO 40-METER INSTARRAY

Since 1975, Dana Atchley, then W1HKK and now W1CF, has been writing about vertical phased arrays. There are some of us who think that he may have the premier signal in the world on 80-meter phone. Recently he has teamed up with Fred Collins W1FC, a co-worker at M/A-COM (formerly Microwave Associates), to create a new entry in the ham-radio antenna manufacturing field. ColAtchCo, formed by mingling the names of the two principals, is in the business of manufacturing practical vertical phased arrays. In other words, it is no longer necessary to merely dream about developing some gain on 40, 80, or 160.

A 40-meter version of the ColAtchCo four-element vertical phased array was erected at K1VR in the fall of 1983. This is the report on that antenna.

Description

The array consists of four verticals set in a square, with sides of 34 feet 5 inches and diagonals of 48 feet 8 inches. Each vertical is made of 6061T6 drawn aluminum tubing, in several sections, with smaller diameters as height increases. A radiator has five six-foot sections topped by a three-foot section. This is the same design for element construction commonly seen in yagis.

In the 40-meter array, the elements are self-supporting and no guy wires are required. Each element sits on a Delrin insulator which is inserted into a steel pipe. The pipe is simply banged into the ground here (not a very demanding job), though the manufacturer recommends pouring concrete footings.

At the center of the array, again sitting on a simple steel pipe five feet long, a relay box receives a 90-degree phasing line made of RG-213 from each vertical. A low-voltage switching line and coax feedline (again RG-213 in my case) then go into the house.

Installation

The 40-meter array is UPS shippable and is reasonably well boxed, so damage in transit should not be a problem. Also, there are hardly any parts which could be damaged by shaking.

Upon opening the box, the use of stainless steel, even for hose clamps, is apparent. The nice thing about these hose clamps, however, is that they have both a stainless-steel wrap *and* a stainless-steel screw. In case you haven't been buying clamps lately, it is very easy to find clamps where the wrap is stainless but the screw is merely plated.

After counting parts against the instruction manual's list, it becomes apparent that there is a considerable amount of work to do before actually erecting the verticals. The site must be selected and the grass mowed (a tip from old-time vertical erectors—mow any grass *very* short and then lay the radials out, holding them down with jumbo-size paper clips rebent into a U shape and pushed into the earth with the radial wire underneath, or staple the radials to dowels driven into the ground). After a few weeks, the radials will simply disappear. The instructions as to setting up the square layout so that all vertical radiators will be in line obviously reflect some field experience, and they were very useful.

About this time, just when I was hoping that it might be possible to erect the verticals that very day, I discovered that there were several items required in the way of tools or materials which were not included in the kit of parts. Not to worry, however. Atchley responded immediately to my suggestion and now promises to include a list of tools and materials.

ColAtchCo sells wire for radials as a separate item, knowing full well that many hams will have some surplus house that they may wish to frequent. In my case, that's exactly what I did, coming home with 10,000 feet (almost two miles!) of #20 AWG insulated wire for a very reasonable $75.00 from Eli Heffron & Sons, a Cambridge MA surplus house. However, before trotting off to the surplus house, I did check around with a few retail stores and wire houses. ColAtchCo prices for the radial wire turn out to be very reasonable, indeed.

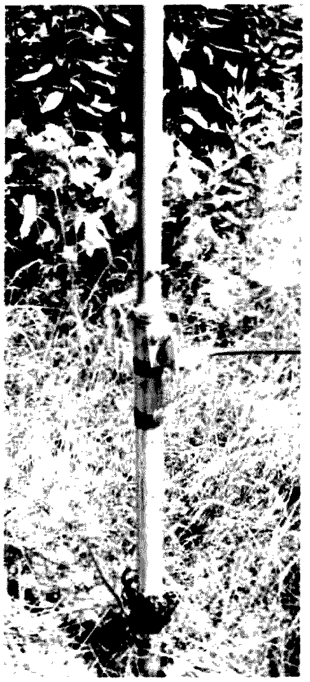


Photo A. The pipe mount is simply sledgehammered into the ground. Note the simple ground system attachment: a long 1/4" #20 bolt with radials soldered into grounding lugs. The two black horizontal stripes are some spare tape left on the pipe.

Photo B. Outdoor relay box mounted on owner-supplied pipe. SO-239 connectors are protected from the weather, but ColAtchCo recommends a plastic trash can, too. Phasing lines came pre-cut. No dummy load is evident because I ran an RG-58 line back into my cellar where I put a Heathkit Cantenna.

By the way, there is some reason to believe that insulated wire is superior to bare or tinned wire for these applications. Archibald C. Doty, Jr. K8CFU made such a claim in his article, "Improved Vertical Antenna Efficiency: A Study of Radial Wire Ground Systems," in *CQ*, April, 1984, page 24.

After careful measuring for correct placement, pounding the base stakes into the ground turned out to be simplicity itself. Here in New England, there is a very real advantage to using steel stakes with Delrin insulators instead of the traditional bottles, or other insulators. The advantage is that you can use a sledgehammer on the metal stake, whether or not the insulator has been inserted. The Delrin survived quite nicely. In addition, in the ColAtchCo system the feedpoint is moved a few feet above ground so that the snow won't be a problem around the time of the ARRL DX contest in the dead of winter.

Coax phasing lines were provided. Worried at first about the fact that they were crimped instead of soldered, I phoned the folks at Gilbert (connector people), who were able to satisfy me that crimped connectors are okay for outdoor work. In addition, these phasing lines are made out of a recognizable Saxton coax, not some unknown brand or generic coax.

At the center of the four vertical radiators ColAtchCo requires its relay box. It appears that they are buying these boxes from Heathkit, as the boxes bear a very close resemblance to the outdoor box in the Heathkit remote coax switch. Further investigation shows that this is *not* the case, and that the relay boxes are specially manufactured for the application. However, the box is obviously a great idea, as it is a proven design and puts all connections on the underside for weather protection.

ColAtchCo uses very ordinary plug-in relays inside the relay box. This is really neat, as the relays are well proven, can easily be replaced should some guest operator change directions while transmitting and try one, and can be replaced on the worst of days without a soldering iron—they are, I repeat, plug-in. Of course, when considering such advantages, the mind continues to think thoughts of how painful it is to work on a 40-meter beam in the dead of winter, at a height where one would really want a 40-meter beam (upwards of 70 feet).

It really is true that one man can erect the 40-meter version. I have also witnessed one man erect the 80-meter, 42-foot version (more about that later). On the other hand, it really does, in a practical sense, take two men to erect the full-size 80-meter vertical radiator.

In preparation for the erection, be sure to think about tree branches that may get in the way should the radiator be lifted in any given direction. I had to do a very small amount of tree trimming.

With the 40-meter version, since one man can easily move it around once it is lifted vertically, I stuck it up in the air like a flag held in a marching band and walked it to the stake on which it would be mounted.

Now get this: There are *no* guy wires on the 40-meter array. The thing is really self-supporting. And note this nice little construction detail: They even provide a cap for the top of the vertical radiator so that water won't drip down the inside of the tubing.

Aesthetically, the fact that there is no guying of the 40-meter array means that the thing is hardly visible. At a total height of 33 feet, it cannot be seen over my one-story ranch house. The array gets lost in my backyard, and although I know what I am looking for, it is extremely hard to see. Not bad for an array which really does develop gain on 40.

Measurements

The results of swr measurements across the band may be quickly summed up. The array is almost flat across the band, at 1.4 to 1 or better. I believe that the differences between directions can be accounted for in the locations of trees, and a small tower some 55 feet away.

As a result of mutual coupling, power will be dumped into a dummy load (which, by the way, must be customer supplied—I use a Heathkit "Cantenna"). For a given frequency, power dumped into the dummy load did not vary. Curiously, however, the power did vary much more drastically than the swr, according to the frequency in use. At 7 MHz, 18 Watts went into the load, at 7.15 MHz, 6 Watts, and by 7.3 MHz, it was back up to 12 Watts. This is not unexpected, as the instruction manual specifies than unless a special order is placed, the antenna comes cut for 7.15 MHz. Given the low swr across the band, this center frequency is entirely satisfactory.

Performance

I used the array for 40-meter monoband entries in both the phone and CW versions of the 1983 *CQ* WW DX Contest. My totals were: phone—184 contacts and 24 zones; CW—327 contacts in 84 countries and 28 zones. This is where my observations become relevant, because I got clubbed by the big multi-multi stations with 3-element arrays (or even 3 over 3) way up in the sky.

Let's face it, at 4.5 dB claimed gain, the array simply doesn't develop the same kind of signal that some of the really big antennas are capable of developing. But then comes the question of how the array compares to 2-element shorty-forty antennas. It was my experience that it ran about even with the Hy-Gain and Mosley and lost to the Cushcraft. But those antennas had to be at 70 feet or longer.

There were other factors, too. I noticed that on long hauls, such as Antarctica, VK, ZL, FB8, ZS, most of South America, and the Pacific, the antenna system performed very well. On the other hand, on high-angle signals into Europe, I saw better performance from my 40-meter delta loop (used for comparison) or my 80-meter dipole fed with balanced feedline (which acts as two half waves in phase on 40 but is only 35 feet high).

I would conclude that verticals have their advantages and their disadvantages. In New England, however, it seems clear to me that the verticals do offer the opportunity to erect a gain antenna on a modest suburban lot without getting into zoning or neighbor trouble, and to be competitive.

Before leaving the subject of comparing performance to that of the 40-meter beams, I should mention one decided advantage that is available to the vertical system owner. Most rotatable antennas work on one-rpm motors. That means that if it is sunrise in Europe (at 0600 UTC) and sunset in the Pacific, it can take 30 seconds to go from working some G to pick up that KH6, and another 30 seconds to go back to working Europe.

On the other hand, using the ColAtchCo array, switching is instantaneous, saving time. In a multi-multi effort, this is of less consequence, since the goal is to work every station on the band eventually. For the single operator in the allband category, however—the operator who wants to work as much as he can and then get out of there—the instantaneous switching arrangement is quite advantageous.

Cost

Though a complete price list is available from the company, one must piece together the elements required. ColAtchCo has recognized that some hams will want to buy only the relay box, only the vertical radiators, only the adjustable inductor, or some combination of the many things that they sell. However, a complete 40-meter array, less only the radials, will cost $856 plus shipping. This does not compare well to the purchase of a two-element short beam alone. However, if a tower, some extra guys, tower climbing help, a new rotator, or other considerations are added to the figuring, the price seems reasonable.

In my situation, I purchased the system while litigating a tower case in the local courts. It allowed me to get on the air with a reasonable signal right away, without pouring concrete and without a 70-foot tower. As I also plan to do some multi-single (multi-operator, single-transmitter) contest work, having an antenna which was "rotatable" without affecting the operation of the main tribander was a real advantage.

Other Arrays and New Products

ColAtchCo has just announced that they are offering an 80-meter vertical which is only 42 feet tall, using a "top hat" made of sloping wires which are continued as guy lines. John Kaufmann W1FV (unaffiliated with ColAtchCo) has done extensive investigation on the theory of such antennas, and he confirms to me that his own experiments with a 39-foot vertical on 80 show a negligible difference between that size and a full-size quarter wave.

Another new product is an 80/160-meter vertical, with top hat guy-wire loading, and a center-loading adjustable inductor, which should be much more efficient than bottom loading. ColAtchCo claims a bandwidth of approximately 50 kHz on 160. This product will be reviewed at another time.

Sadly, ColAtchCo has not yet invented what I would really like. I'd like to increase the height of my existing array from 32 feet to 42 feet, add the top hat, and then have a two-band array: four half waves at a quarter-wave spacing on 40 and four quarter waves at one-eighth-wave spacing on 80. Then I would simply erect a single 160-meter vertical elsewhere on my property.

The other configuration which they haven't invented yet, suitable for my yard, would be a two-element 80-meter array, switchable so that both elements are also usable as a directional array on 160, with gain.

Despite my disappointment that they haven't invented what I really want yet, I am very interested in their work. I'm staying tuned.

It looks as though the initial products introduced by ColAtchCo are well built and they work. They appear to be on the edge of some clever engineering which will permit multiband, low-band, direction-switchable gain antennas without zoning problems. Not bad.

A brochure, including a fairly detailed discussion of what they do, and price list are available from *ColAtchCo, PO Box 230, Carlisle MA 01741*. They do have a telephone, *(617)-371-1242*, but it is not always manned by a human.

Fred Hopengarten K1VR
Lincoln MA

WHAT DO *YOU* THINK?

Have you recently purchased a new product that has been reviewed in *73*? If you have, write and tell us what *you* think about it. *73* will publish your comments so you can share them with other hams, as part of our continuing effort to bring you the best in new product information and reviews. Send your thoughts to Review Editor, *73 Magazine*, Peterborough NH 03458.

FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

A VIDEO VENTURE

Here's the question of the month: Why isn't ham TV more popular?

It puzzles me. Most hams I know are very outgoing. Most will drag people off of street corners to look at their stations. Most will talk your ear off about the wonders of ham radio. But few have ever operated TV.

Yes, I know SSTV is relatively popular. But I'm talking about ATV—standard fast-scan video—the type you can watch "Laverne and Shirley" or "The Honeymooners" on (if you cut out the music, of course).

It's hard to come up with a reason for the downright unpopularity of ATV. Okay, most of us aren't what you might call handsome, but that never stopped hams from going to club meetings or speaking up in front of a group at a ham convention. No, looks aren't the problem.

I think most hams have just never thought about ATV. We know that it's there, but I don't think we know how much fun it can be. Well, my face has cracked a few vidicons and monitors in its time, and I can tell you that ATV is a lot of fun.

With low-cost portable VCRs now available all over the place, you can put together mini-documentaries on your club's latest meeting or hamfest. You can show the ham world, in color, just how fantastic your stacked array is. Why, with a little ingenuity, you can even figure a way to play video games over the air. Want to have ham radio to impress a kid? Then show him (or her) ATV.

So get off your Cantenna and look into the world of ATV. And if you need some inspiration, let this month's quiz put you into the mood.

ELEMENT 1
MULTIPLE CHOICE

1) The event at which TV had its first public demonstration was:

1) The 1933 Presidential Inaugural

2) The 1939 New York World's Fair
3) The 1938 San Francisco World's Fair
4) The 1933 Chicago World's Fair

2) In 1955, what weighed 280 pounds, used 35 tubes, and required 375 Watts of power?
1) A color TV camera
2) A color TV receiver
3) A color TV transmitter
4) A color video switcher

3) What are the two basic TV scanning systems?
1) Interlaced and sporadic
2) Interlaced and random
3) Random and sequential
4) Sporadic and sequential

4) Which of the following sit-coms *never* had an episode dealing with amateur radio?
1) "Hazel"
2) "The Munsters"
3) "Green Acres"
4) "My Favorite Martian"

5) The first TV station to broadcast on a regular basis was:
1) WNBC, New York
2) WGY, Schenectady
3) KNXT, Los Angeles
4) WXTV, Philadelphia

ELEMENT 2
TRUE-FALSE

	True	False
1) A Plumbicon is a type of TV picture tube.	____	____
2) An image orthicon is a video pickup tube used in state-of-the-art TV cameras.	____	____
3) CBS proposed the first "all electronic" color TV system.	____	____
4) WR4AAG was the first ATV repeater.	____	____
5) From the late 1920s through the late 1930s, the most popular television character was Felix the Cat.	____	____
6) TV video is transmitted in FM.	____	____
7) TV audio is transmitted in AM.	____	____
8) The TV movie, "The Day After," prominently featured ham radio.	____	____
9) NBC's first TV station was New York's W2XBS.	____	____
10) "Channel 1" is now the amateur 2-meter band.	____	____

ELEMENT 3
MATCHING

Match the TV pioneer in Column A with his accomplishment in Column B.

Column A	Column B
1) John L. Baird	A) German scientist who invented the scanning disk
2) K. F. Braun	B) Englishman who formed the first company exclusively devoted to television
3) Paul Nipkow	C) Invented the cathode ray tube
4) Vladimir Zworykin	D) Russian emigre who invented the image iconoscope
5) E. F. W. Alexanderson	E) Chief television consultant for General Electric, he conducted many important TV experiments for the company in the 1920s
	F) Invented the "radioscope"

ELEMENT 4
FILL IN THE BLANK

1) A US TV picture ordinarily contains ____ lines.
2) ATV audio is usually carried on a ______ MHz subcarrier.
3) The standard vertical sweep frequency is ______ MHz.
4) VIR is the abbreviation for ______ ______ ______.
5) The time prior and subsequent to the sync pulse is the ______ period.

THE ANSWERS

Element 1:

1—2 April 20, 1939, to be exact.
2—1 Not exactly what you would call a mini-cam.
3—2 The interlaced system is the one most commonly used.
4—3 Remember Mr. B's TVI problem? Remember Herman talking to Mars (the planet, not the service) on his radio? Remember Uncle Martin's alibi for all that strange electronic equipment? The networks sure had a strange view of our hobby.
5—2 In 1928.

Element 2:

1—False It's a video pickup tube used in TV cameras.
2—False Image orthicon tubes have not been widely used for about 20 years.
3—False CBS's system featured a spinning mechanical disk.
4—True In Washington DC.
5—True A foot-high statuette of Felix was used in a variety of TV tests during those years.
6—False No, AM.
7—False No, FM.
8—True Sure. Remember all those poor survivors radioing for help from the college's radio club?
9—True As the call indicates, it was an experimental station. The year was 1931.
10—False Six meters.

Element 3:

1—B, 2—C, 3—A, 4—D, 5—E.

Element 4:

1—525
2—4.5
3—59.94
4—vertical interval reference
5—blanking

SCORING

Element 1:
Seven points for each correct answer.
Element 2:
Three points for each correct answer.
Element 3:
Eight points for each correct answer.
Element 4:
Five points for each correct answer.

How did you do?
1-20 points—In a blind spot
21-40 points—Waiting for Uncle Miltie's return
41-60 points—One set home
61-80 points—Man of vision
81-100+ points—Video Ranger

NEW PRODUCTS

Θ-777 COMPUTER INTERFACE

Amateur-Wholesale Electronics has announced the new Tono Θ-777 computer-interface terminal, featuring RTTY, AMTOR modes ARQ, FEC, and SEL-FEC, ASCII, and CW, at any speed and any shift.

The Θ-777 is a self-contained unit including software that allows reception and transmission with any computer or terminal that has RS-232 or TTL I/O. The Θ-777 automatically decodes signals and displays the mode, speed, and polarity on the CRT. A bar-graph tuning indicator allows precise centering of received signals.

In Baudot or ASCII mode, communication speed can be set from 12 to 200 baud using the modem, or 12 to 600 baud using TTL levels. Morse speed can be varied from 5 to 100 wpm in 1-wpm increments and is tracked automatically during receive.

Other features of the Θ-777 include 15 channels of message memory, plus a 768-character type-ahead buffer, manual/automatic PTT switching, selective calling, provision for tape-recorder backup memory, automatic carriage return and line feed, CW random generator for code practice, variable CW weight, test messages (RY and QBF), bit inversion for RTTY reception and transmission, diddle, echo, full CRT function display, audio monitor, mark-only or space-only reception, crystal-controlled AFSK modulator, anti-noise feature, and more. The instruction manual provides sample computer terminal programs for use with NEC or Apple II personal computers.

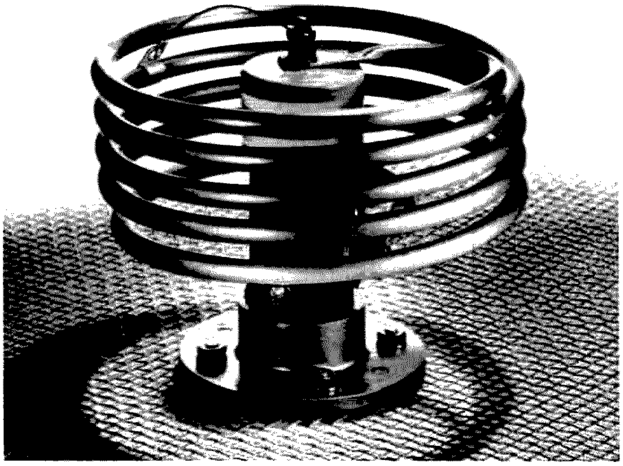
The Θ-777 operates from a power supply of 11 to 14 volts dc. The unit measures approximately 2.5 inches high, 9 inches wide, and 10 inches deep. For more information, please contact *Amateur-Wholesale Electronics, Inc., 8817 SW 129 Terrace, Miami FL 33176.*

The ICOM 3200A dual-bander.

ICOM 3200A DUAL-BANDER

ICOM has announced the IC-3200A, a 25-Watt VHF/UHF transceiver. The IC-3200A is simple to use and offers extended 2-meter frequency coverage (140–150 MHz), ten MHz of coverage in the 70-centimeter band (440–450 MHz), and 5-kHz-step fully-programmable offsets for MAS and CAP repeater operation. The IC-3200A also features ten tunable memories, multimode scanning, and a built-in duplexer for single-antenna operation. The rig comes with an IC-HM14 scanning microphone, a dc power cord, and a mobile mounting bracket.

For complete details, contact *ICOM America, Inc., 2380 116th Avenue NE, PO Box C-9029, Bellevue WA 98009-9029.*



The Com-Rad CR109A helical antenna.

COM-RAD UNTENNA

Com-Rad Industries has expanded their line of low-profile Untennas with the introduction of their CR109A helical. Weighing only three pounds and standing a mere 5-3/4 inches tall, the CR109A will handle up to 200 Watts of rf from 27 to 85 MHz. A tuning slide allows easy frequency selection. Untennas are constructed of durable stainless steel, aluminum, phosphor bronze, and chrome plate and use nonmetallic support structures.

Also available from Com-Rad is a protective radome. The radome is made of high-impact, UV-resistant plastic and may be painted with any nonmetallic pigment.

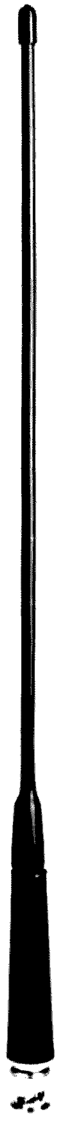
For more information, contact *Com-Rad Industries, 25 Imson Street, Buffalo NY 14210; (716)-823-0331.*

LARSEN HALF-WAVE UHF ANTENNA

Larsen Antenna's new KD 14-450-HW antenna is a full half-wave UHF antenna for portables which interfaces with any portable using a BNC connector.

The KD 14-450-HW is an excellent antenna for any UHF application requiring maximum performance. Because of its inherent resonance, it may be easily remoted via a coaxial line from the portable. The overall whip length is 12", and the impedance transformer at the base of the whip is 3.25" long.

For more information, contact *Larsen Electronics, PO Box 1799, Vancouver WA 98668; (206)-573-2722.*



Larsen's half-wave UHF whip.

HAL MULTIMODE TUNING AID

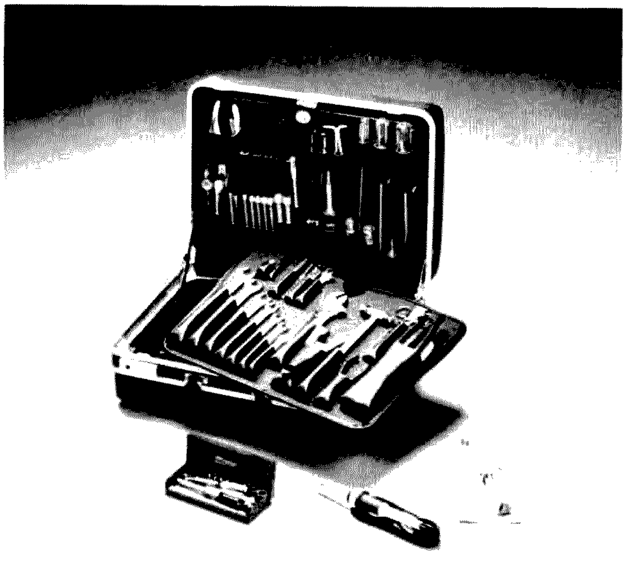
Hal Communications has announced their new SPT-1 Spectra-Tune multimode tuning indicator, which allows perfect tuning of CW, RTTY, FAX, and SSTV signals. A calibrated 40-segment LED bar graph gives a visual indication of RTTY shifts and provides an indication of which direction to tune the vfo for zero beat. The display is also useful in adjusting filters and passband-tuning parameters. An audio input and a 12-V-dc supply are the only connections required for operation.

For complete information about the SPT-1, contact *HAL Communications Corp., PO Box 365, Urbana IL 61801.*

The Hal SPT-1 Spectra-Tune multimode tuning indicator.

JENSEN COMPUTER KIT

The JTK-76 Computer Systems Maintenance Kit from Jensen Tools contains a complete selection of tools for in-the-field troubleshooting, service, and repair of CPUs, desktop computers, high-speed

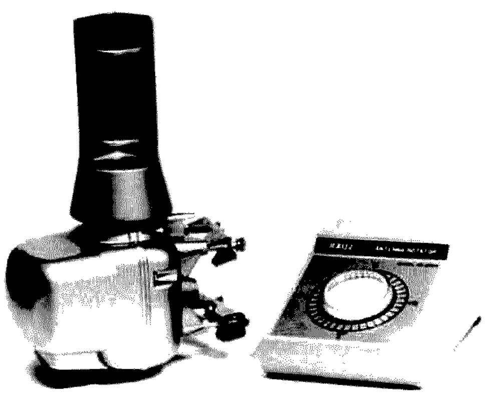


The JTK-76 Computer Systems Maintenance Kit from Jensen Tools.

printers, and word processors. The JTK-76 kit features long-bladed screwdrivers, a 7-inch extension blade for use with the selection of nutdrivers and hexdriver blades, a penlight, and complete sets of combination wrenches, socket wrenches, measuring tools, pliers, cutters, soldering equipment, and more. The tools are contained in a deep injection-molded attache case with two removable pallets and ample space in the bottom for additional tools, test meters, or other equipment.

For more information or for a free catalog of Jensen's full line of hard-to-find tools, service kits, cases, and test equipment, write *Jensen Tools, Inc., 7815 S. 46th Street, Phoenix AZ 85040; (602)-968-6231.*

ANTENNA ROTOR FROM CMC



The AR-200XL antenna rotor from CMC Communications.

The AR-200XL rotor from CMC operates on 115 V ac and provides 220 in.-lb. of motor torque to turn an antenna array or surveillance camera. Full 360-degree rotation is achieved in 60 seconds. Motor voltages are held below 18 V ac for safety and only 3 conductors are required between the control unit and rotor. This keeps the system very economical through simplified design and ease of installation. The control unit incorporates a demand-heading control and a present-heading indicator presented concentrically on a compass rose. The new rotor, designed for medium duty, will support a vertical load of up to 100 pounds with a wind loading of 5 square feet.

For further information, contact *CMC Communications, Inc., 5497 Jetport Industrial Blvd., Tampa FL 33614; (813)-885-3996.*

PROTECTION GUIDE AND CATALOG

Electronic Specialists is offering a 40-page color catalog describing power-line problems such as noise and high-voltage spikes. Typical communication interference problems and suggested solutions are included, and hundreds of protective and interference cure products are described. Request Catalog 851 from *Electronic Specialists, Inc., 171 S. Main St., PO Box 389, Natick MA 01760; (800)-225-4876.*

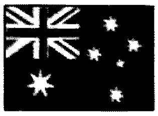
HANDY A/S WALL CHART

The Antenna Specialists Co. has come up with an ingeniously simple chart that permits quick and accurate identification

73 INTERNATIONAL

Each month, 73 brings you ham-radio news from around the world. In this collection of reports from our foreign correspondents, we present the latest news in DX, contests, and events, as well as keep you abreast of the technical achievements of hams in other countries.

If you would like to contribute to your country's column, write to your country's correspondent or to 73 Magazine, Pine Street, Peterborough NH 03458, USA, Attn: Perry Donham KW1O.



AUSTRALIA

Kirsti Jenkins-Smith VK9NL
PO Box 90
Norfolk Island
Australia, 2899

NORFOLK ISLAND

Except for radio amateurs, not many people in the world have ever heard of Norfolk Island. 3 × 5 miles, Norfolk Island has a resident population of some 1600 persons, seven of whom are licensed amateur-radio operators. At present, Jim VK9NS is working in Papua New Guinea (P29JS), so Norfolk Island is not heard from nearly as often as it used to be. John VK9JA, the longest standing call here, goes on the band to give weather information to yachts in the area. Mick VK9NW has an occasional rag-chew, Les VK9NI, ditto, Bob VK9ND sometimes works into the USA, preferring a chat with each contact. The only YL on the island, I am the only one active on CW these days.

In spite of the relatively small active amateur-radio population, Norfolk Island is remembered for its role in organizing the first-ever expedition to Heard Island fully and solely organized by amateur radio.

Heard Island is the "forgotten island," Australia's westernmost territory, on the fringe of Antarctica. Norfolk Island is Australia's easternmost territory, 900 miles out in the Pacific Ocean. 6300 miles, as the crow flies, separate these two islands. (Much more when considering the crooked ways man must travel.)

There is no need to deliberate on the amateur-radio expedition from Norfolk to Heard Island. It has been adequately covered in *73* in July, 1983. Suffice it to say that the expedition was not the end of an organization. Far from it. The Heard Island DX Association formed an international club of keen DXers who work together to promote amateur radio and DXing generally. The club now has 120 members from 25 countries, based on tiny Norfolk Island. President is Jim Smith VK9NS, temporarily P29JS, originator and founder of the club.

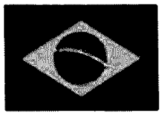
Jim also started the now famous 14.220 net during his previous stay in P29-land. The net moved from strength to strength, 280 countries having checked in at some time or other by the time Jim moved to Norfolk Island. He continued running the net from here, and so it came about, in good propagation, that Norfolk Island became the focus of world attention for a couple of hours each day. No mean feat for an island so few have heard about.

Conditions these days are, as we all know, poor. Especially from the Pacific into USA. 40-meter CW is just about the only possibility from Norfolk Island in that direction. However, there are days when the odd USA station surprises us with good signals checking into the 14.220 net. Not often, and not many, but it happens.

The bulk of Norfolk Island is a plateau on top of the 200–300-foot cliff surrounding most of the island. This is where the residential areas are. We have no congestion of houses or high-rise buildings to block radio signals. What we call "the mountain"—Mt. Bates, 900 feet above sea level—is tucked neatly out of the way, not obstructing anything. Thus Norfolk Island lends itself to amateur radio as well as such holiday activities as photography and basking in the sun, etc.

In reasonable conditions, 100 Watts and a dipole can give amazing results. 100 Watts and a beam is ample even in today's conditions. 150-foot-high Norfolk pines are ideal for anchoring an antenna. (Some people do actually climb these giants, though most often to saw the tops off for aviation safety's sake.)

The six amateurs on Norfolk Island have not found any need to form a club. We go on the bands and do our own thing. License requirements are the same as in Australia, licenses being issued by the Australian Department of Communications.



BRAZIL

Gerson Rissin PY1APS
PO Box 12178 Copacabana
20000 Rio de Janeiro, RJ
Brazil

As most of you know, my first home QTH was the city of Recife, located in the northeast part of Brazil. I was born in that city and there I got my first license in 1965, which was PY7APS. With this callsign I operated up to 1972. During that period of time, I went twice to Fernando de Noronha Island for DXpeditions. In 1967, my callsign was PY7APS/Ø and in 1968 my call was PYØAPS. The last time I returned to the island was in 1979; I used the same PYØAPS callsign.

Since 1972 I have been living in Rio de Janeiro City with the new license, PY1APS.

Due to its geographical situation, Recife is the last point on the way to the rare spots in the Atlantic Ocean along the Brazilian coast. Because of that, a few PY7 stations were able in the past to activate DXpeditions on Fernando de Noronha Island and especially the first and second DXpeditions on St. Peter and St. Paul Rocks.

Attributable to my job, I go to Recife every two months. During these opportunities I have the chance to visit my parents and relatives, and when I have free time, I visit my friends, the DX gang of Recife.

Two months ago I met Bart PY7AKW who also operated many years ago on Fernando de Noronha Island while living on the Brazilian army base on the island. Bart was also one member of the group in the first and second DXpeditions to St. Peter and St. Paul Rocks. His call both times was PYØSP. He was a very active DXer in the past, but in the last fifteen years he has been very busy with his duties as Colonel of the Brazilian Army and as an English teacher at night in a high school in the city of Olinda. He'll be retired at the beginning of 1985, and after that he expects to be active again.

Last week I was in Recife again, and this time I was able to join three good friends: Fred PY7ZZ, Andre PY7CW, and Jim PY7BXC. Between one piece and another of lobster (the ocean in that region is rich in lobsters) or beer, I found that we all already were, for a few days, a PYØ station. So it was a good idea to have a picture with all of us. Andre gave his camera to our waiter, who took the picture.

We all operated from Fernando de Noronha Island, and among us PY7BXC was the only one who operated also from St. Peter and St. Paul Rocks.

Fred PY7ZZ is one of the most active DXers of Brazil. He got his license in May, 1969, as PY7AZQ and then he changed his call to PY7ZZ. His father, Mario PY7EC, was also very active in DX at the time of the AM transmissions. Due to his job as a philologist, Mario doesn't have time enough to be as active as he was earlier. Fred is a DXCC Honor Roll member and his score now is 312/323. He was the second station in the state of Pernambuco to reach this level (I was the first).

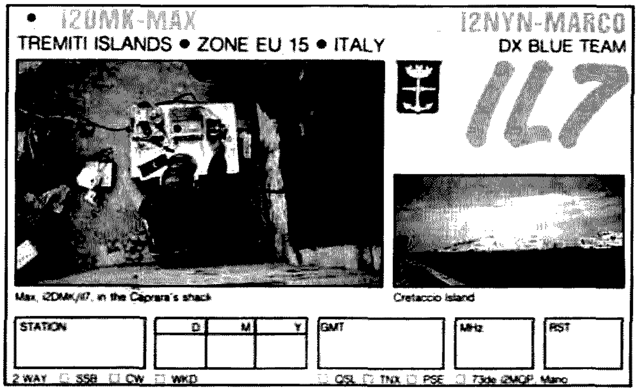
Fred also acheived the 5BDXCC and is finishing now the 5BWAZ. He needs only a few zones on eighty meters. Fred likes contest and QRP operation on the ten-meter band. With his seven-Watt PEP equipment (a modified CB), he worked 230 countries on 10 meters. He uses a Drake 4XC and R4C, a Yaesu FT-201, and a Brazilian linear amplifier, MAC L 2000. The antennas are a three-element yagi for 10, 15, and 20 meters and dipoles for 40 and 80.

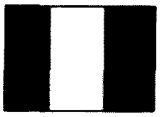
Next time I'll try to get in touch with more friends.

Left to right, Jim PY7BXC, Andre PY7CW, PY1APS, and Fred PY7ZZ.

Bart PY7AKW (left) and PY1APS.

An ID7 native watches while I8YUZ and I8TSL (right) erect antennas.





ITALY

Mario Ambrosi I2MQP
Via Stradella, 13
21029 Milano
Italy

EXPEDITIONS

Recent months and the summer of 1984 have seen a lot of activities from Italian amateurs. As we do not intend to bother you too much with stories that are more or less always the same, we will only show you pictures. They will give you a better idea of the situation.

First, the ID7 expedition and the photo of the job of mounting the antennas. Left is an ID7 native very interested in what was happening on his island. The other two, much more involved in the job, are I8YUZ and I8TSL. The QSL card is of the *I2DMK* and *I2NYN* expeditions to *IL7. QSL* cards for IL7 and 4U1ITU via I2MQP. In any case, all contacts have already been confirmed via the bureau and the first ones sent to the ARRL have been the ones for many contacts we had with the States on 40 meters, the only band where the propagation was good.

PROPAGATION

With ten meters dead and fifteen very noisy and closed for most of the day, the traffic to the US is now diverted to twenty meters. But this band closes very early during winter and the only possibility to have some activity after 8:00 pm is to go on 40 and 80.

While 80 is preferred for local traffic, as we are limited to the use of a small portion of it between 3613 and 3667, 40 meters is more suitable for DXing. Beautiful propagation has been found during the Christmas period between 0300 and 0700 UTC with a lot of stations from zone 3 coming to Europe with signals strong enough to work them with a simple dipole. I do live in a flat and use a simple dipole, but a few hundred meters from here a good friend of mine, Massimo I2DMK, for whom I am the QSL manager when he goes on an expedition, has just mounted a 4-element KLM monobander for 40 meters. I have often stopped in front of his OTH to give a look to the monster, but let me say that it does not seem to be so big on top of an 18-meter tower that is on top of a 10-story building.

The results from this antenna, with the help of a Henry 3K and the CW skill of I2DMK, are impressive. I do not copy many of his correspondents, but if he is not joking there are hundreds of Ø, 6, and 7 calling. Wish I could do something like that!

But you can work the Pacific Coast with a simple sloper. It was a surprise to a local CW man, I2CZ, that he received the reply of Steve AA6AA while calling CQ at 7005. It was 1500 UTC the first of January; Steve has confirmed he was working via long path and passed me wishes for a happy 1985. It was a nice contact for I2CZ and a nice surprise for I2MQP.

ARI INTERNATIONAL CONTEST

If you like to work contests and for awards, here is something for you. the Italian contest is becoming international and is offering you the possibility to get the Italian Provinces Award. See details in the box.

RADIORIVISTA

It's the name of our national radio magazine and it has presented during the last two issues some interesting topics.

One was a long article on a mailbox that was based on the Commodore 64; the full program was presented with several pages of explanation. A version of the same but using the AMTOR has been implemented and installed and working for a few months. Should somebody be interested in it, the microcomputer manager of ARI, IØFLY, is at your disposal.

Another issue covered was the problem of getting QSL responses. I wrote about it, and from my statistics it has appeared that amateurs in different countries are replying in different ways. If you work an HB station, you have 71% chance to get a reply in a reasonable amount of time. It's the same for a PA, but it goes to 68% for a JA. Italians do not reply very much to other Italians (only 31%) but it's certainly different for US stations.

Looking at others, you can see great differences: Y2—70%, LX—54%, OK—56%, SM—55%, YO—45%, but look at TG—0%, TI—10%, YS—0%, 6Y—0%, CO—7%, HP—8%, HR—0%, and JY—0%.

This was based on 30,000 cards (sent via bureau) during the period 1977 to 1983 inclusive. Maybe the situation will improve. May I present to you how the situation is for the States?

Contacts confirmed with a QSL card: W1—27%, W2—32%, W3—35%, W4—37%, W5—34%, W6—31%, W7—34%, W8—41%, W9—38%, WØ—35%, KL—26%, KH—33%, and KP—20%.

Not too bad, but there is still a lot of space to improve, and I hope you *will* improve; otherwise, my awards are lost.

Always talking about cards, a full page in the magazine has been reserved for N7RO and his DX QSL Service, while a page and an half was reserved for W3HNK (half a page more than N7RO as Joe is half Italian!).

See you in a couple of months, guys, and remember, if you do pass through Italy, you are always welcome here.

ARI *INTERNATIONAL* CONTEST

DATE: From 1600 UTC Saturday, May 18, 1985, to 1600 UTC Sunday, May 19, 1985.

World amateur radio must contact Italian stations including San Marin, Vatican City, and SMOM.

CLASSES: Single operator CW, single operator SSB, single operator RTTY, single operator mixed mode, multi-operator single TX, SWL. Multi-operator station can use all modes (CW, SSB, RTTY).

BANDS: 28, 21, 14, 7, 3.5, and 1.8 MHz

EXCHANGE: RS(T) + QSO number starting with 001. Italian stations will send RS(T) + QSO number + two letters (province).

QSO POINTS: For European stations, 2 points for every QSO with an Italian station. For Extra-European: 4 points for every QSO with an I station.

MULTIPLIERS: 1 multiplier for every "province" per band. San Marino, SMOM, Vatican City, and the memorial Marconi stations IY1TTM and IY4FGM are additional multipliers.

FINAL SCORE: The sum of QSO points from all bands times the sum of the multipliers from all bands.

LOG: Must contain date, time in UTC, band, mode, call, exchange, score, and new multiplier. Use separate logs for each band.

Include a summary sheet with your callsign, class of participation, QSO points and multipliers on each band, and final score.

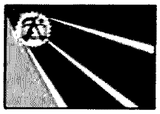
Don't forget your full address, your rig description, and your comments. Log *must be mailed within 40 days from the end of contest to: Giorgio Beretta I2VXJ,* via Sciesa 24, 20135 Milano, Italy, or Contest Manager, c/o ARI, via Scarlatti 31, 20124 Milano, Italy.

PENALTY: Log without a summary sheet and a declared score will be used as control log. A declared score 5 percent more than the actual score means disqualification.

AWARD: Special awards will be issued to the top five of every class of participation. A certificate will be awarded to the top scoring operators in each country and for each category.

WAIP: The Worked All Italian Provinces Award is issued to all amateurs for contacts with 60 different provinces. This will be issued upon a written application in the log and a separate list of QSOs for the award. QSL cards are not required for contest QSOs. Thank you for your participation.

Contest Manager I2VXJ
(Giorgio Beretta)



MOZAMBIQUE

Charles E. Martin AB4Y
American Embassy Maputo
Department of State
Washington DC 20520

The views and opinions presented are my own and not necessarily those of the State Department or the US Government.

Which country in Africa has the longest coastline? Well, Trivial Pursuit buffs, it's Mozambique. Mozambique is a large (twice the size of California) country located in southeastern Africa. The capital and largest city, Maputo, is located in the extreme southern end of the country on Maputo Bay. The city is quite lovely, with an abundance of foliage, trees, and attractive parks. My home is an upstairs apartment with a red tile roof. The downstairs neighbor is Len Keating KA3NJY.

Amateur radio is currently suspended in Mozambique. There has been no operation since 1976 (according to Lars Dahlgren SMØDQE, also a resident of Maputo). Conditions now are available, however, for the return of amateur radio. Like many other developing countries, Mozambique is poor. There is also a shortage of trained technicians. There is an ambitious program underway to improve the education of the population.

With such a large country, telecommunications is a challenge. The government of France has provided a substantial amount of aid towards the country's ambitious goal of improving communications services. A Swedish concern is providing new telephone equipment in Maputo and also assisting in the training of local tech-

nicians. There are nearly 800 Swedes in Mozambique. Mozambique does have a television station which broadcasts 4 hours per week, only on the weekend. In Maputo, many individuals can receive television signals from 3D6 or ZS.

The local expatriate hams have joined together and created the Maputo International Amateur Radio Association (MIARA). The chief goal of MIARA is to get amateur radio reestablished in Mozambique. Our first guest speaker at our first meeting was Milheiro Ferreira CT1BF, the director of the international cooperation bureau of the Portuguese telecommunications authority. His feeling was that the outlook for the return of amateur radio to Mozambique is very favorable. Other individuals who were present also shared his optimistic viewpoint.

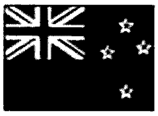
Another guest was Eduardo da Motta, a Portuguese instructor of electronics who is employed at Eduardo Mondlane University in Maputo. He was very enthusiastic about the possibility of reactivating the club station at the university. He was shown some reports of the activity at BY1PK and YI1BGD and he was impressed.

Amateur radio exists to serve mankind, and a challenge exists right here in Mozambique. The international amateur-radio fraternity could help provide the equipment and technical materials to assist the country in realizing its ambitious goal of improved telecommunications.

MIARA is planning a DXpedition to the islands of Juan de Nova and Europa during the summer of 1985. (This is the *winter* of 1985 for us in the southern hemisphere.) The scientific attache at the French embassy here is providing assistance in the form of landing permits and licensing and translation. Kjell SM7DZZ owns a 40-foot sailing craft (don't ask me what kind it is; all I know is that it floats) and he is willing to provide transport for us. We are researching the awesome logistical problems inherent in such a venture. The islands have no potable water supply so we must carry our own, and that will be 3 gallons per man/day. We must carry our own electrical power. We discussed taking along a non-ham to assist, but due to the supply problems we decided to forego this luxury. I have been advised that the greatest need is for 40/80-meter CW and also that 160 is needed as well. We will try to tailor our schedule to meet the greatest need.

I will be traveling to Dayton for the 1985 Hamvention. I am hopeful that amateur radio will reappear in Mozambique before I make the journey.

The shack at ZL6IW.



NEW ZEALAND

D. J. (Des) Chapman ZL2VR
459 Kennedy Road
Napier
New Zealand

Kia ora atu i Aotearoa. In a previous column, I made mention of the unique ZL station, ZL6IW, the NZART Official Monitoring Service station operated by Bob Knowles ZL1BAD, of Tuakau, near Auckland. Bob is also the IARU Region III Monitoring Service Coordinator, as well as the ZL coordinator of our Intruder Watch service (monitoring service).

The special callsign, ZL6IW, is not permitted for normal use on the amateur bands but is used expressly to make contact with non-amateur stations intruding into our exclusive sections of the bands.

Bob is assisted in his monitoring work by several ZL amateurs who regularly monitor the bands from their home OTHs and forward written reports to the Monitoring Service on a weekly/monthly basis. Our regulatory body, the New Zealand Post Office, recognizes the importance of the work Bob and his helpers do, hence the reason for the special callsign allotted to the official coordinator for his use in intruder situations. This month I am including a report and photograph by Bob about the station, through the courtesy of *Break-In*, NZART's monthly magazine. The photo is of the operating position, and the gear is described in the text.

ZL6IW

The requirements of the Monitoring Service have dictated the assembly of a station equipped to handle many of the non-amateur signals now appearing within the amateur bands. It is apparent from questions asked at meetings and on the air that there is some interest in this station, so, for those readers who enjoy a visit to the other guy's shack, here is a rundown on the shack at ZL6IW.

The "great hulking beast" on the right in the photograph is a Marconi HF spectrum analyzer; those aspiring to Olympic weight-lifting events are welcome to train on this one—its weight is 305 pounds. On the top of that is a modified Pye VHF receiver, used for checking the 2-meter band. Below the beast is a Dymek scanning receiver—0.5 to 40 MHz—and under that is a Hewlett-Packard audio spectrum analyzer. Tracking left in the photograph, next is the SWTP 6809 computer with its twin disk drives, monitor, and printer. This unit is used for record handling and sorting, etc., but slowly (as software is written) moving into signal analysis.

To the left again is the main tape recorder, used for long period monitoring—other recorders are in the drawers under the bench and coupled to the receivers. The flat-looking object in front of the tape recorder is a Burroughs FAX machine modified for 60, 90, 120, 180, 300, and 360 rpm in either AM, FM, or CCITT modes. It also comes in handy for checking on the weather. Left again, is the TONO 9100E with its PSU and monitor. This unit is probably used more than any other item in the shack, especially on commercial RTTY. Next is the Yaesu FT-107M with its various auxiliary units, on top of which is a Dymek audio filter. Finally, to the left is a wide (very) band FRG7 receiver. Not shown (they didn't make the lens angle of Bob's camera wide enough!) is the frequency-measuring department. Under the bench is a Marconi HF dual beam scope, used mainly for the determination of "simo-sync" problems with harmonic and spurious RTTY signals.

This assortment is fed with a modest antenna array consisting of two-element quads, longwires, dipoles, etc. Some phased Beverage antennae are under construction. Unfortunately, Onewhero (where Bob lives) does not have sufficient flat land upon which to erect some more sophisticated specialized receiving antennae, but the arrays he has do him very proud, and provide NZART with an excellent Monitoring Service station.

Vern Haig ZL4JN works another JOTA station from St. Patricks Hall, Dunedin. Listening in are Kylie Fraser of St. Patricks Guides (left) and Nicholas MacKechanie of St. Patricks Cubs. (Photo—Otago Daily Times*)*

JOTA

Also from the same issue of *Break-In* is information on the 27th Scout Jamboree On The Air from Jim Parnell ZL2APE, National Organizer for the Scouts in ZL.

The 27th International Scout Jamboree On The Air was held over the weekend of 20/21 October, and as it was a long holiday weekend in New Zealand it was not surprising that Scout camps seem to have been the main feature of JOTA this year. Also Labor Weekend, the weekend concerned, is considered the start of the camping season here in ZL, even though the weather is sometimes a little suspect so early in the season. The weather this year was fairly kind for the two days of JOTA, although the holiday Monday was not too good.

Despite generally poor band conditions, there were many good contacts, and being able to work right up to midnight on the Sunday was a bonus (no school the next day because of the holiday). In past years, the cutting off of the activity at mid-day Sunday, whilst the rest of the world was in full swing, always seemed a pity.

Some band openings allowed a few contacts with Europe, however most DX was with countries around the Pacific. The aggregate score of countries for all New Zealand stations was only 20% of DXCC.

To get an electrically quiet area, Hugh ZL2BHK went deep into the hills to the west of Upper Hutt, Wellington, with an FT-101, 150 Scouts, and their leaders. Spurning the luxury of an engine-alternator for power, (actually he didn't like the cost of gas for the 48 hours running, gas presently being about $4.00 per gallon) he borrowed the car batteries of every vehicle in sight or which visited the Camp. As a result, push-starts became the norm for starting the vehicles again!

It was good to be able to meet once again so many friends of past JOTAs, especially the Rarotongan Scouts at ZK1BS. These boys found themselves in great demand by JOTA stations everywhere. After 36 hours of operating from Rarotonga, they had made 57 contacts, and were even able to use their native tongue when working ZL2AYZ at a camp near Johnsonville, near Wellington, as a Scout leader at that camp was an expatriate of the islands. Through him, they told the New Zealand boys one of the legends about how the Cook Islands came into being.

The antenna at the Johnsonville Camp performed well—as it should when supported by a Scout-constructed tower. However, their best DX was a JOTA station in Venezuela. Unfortunately they missed the opening into Europe.

Vern ZL4JN, operating at the St. Patricks Scout Hall in St. Kilda, Dunedin, had a visit from the local newspaper, the *Otago Daily Times*; see photo.

Every Jamboree On The Air is, in its own way, successful, in that it gives Scouts and Guides who are taking part an opportunity to share in their international friendships that are basic in their movements. These opportunities are all too few because of time, cost, and distance factors, factors which largely disappear with the aid of amateur radio. JOTA also introduces Scouts and Guides to the hobby of amateur radio with the result that some will gain their own amateur licenses at some time in the future. The exposure can be only of benefit to amateur radio, whose "greying" membership is of concern here in ZL.

However, the now-and-again coinci-

dences of JOTA and ZL's Labor Weekend is unfortunate, as on these occasions when the two events do clash, participation is much lower than normal because of holiday weekend commitments. This year, the number of ZL stations was down by 25%, and even with the great help of JOTA Camps numbers of participants were down to about 45 percent. Actual ZL figures were about 104 stations and 2700 Scout and Guide participants. Worldwide figures are anybody's guess—last year there were about 300,000 Scouts and Guides from 100 countries taking part.

Next year's JOTA will be held 19/20 October, the weekend before our New Zealand holiday weekend, so there should be an increase in ZL JOTA stations, but they will have to close down earlier as the children will have school as usual on the Monday.

NZART ANNUAL CONFERENCE

Some information for the traveling amateurs: NZART's Annual Conference next year is being hosted by the Christchurch area (ZL3-land) and is aptly named the Garden City Conference. The Conference will cover the days of our Queen's Birthday Weekend, 31 May to 3 June, 1985. The venue for most of the activities will be the Student Union building of the University of Canterbury in Christchurch. For further information, please write direct to the Conference Committee, PO Box 29-040, Fendalton, Christchurch, New Zealand. The weekend's activities, besides the Conference, include forums, social functions, a convention dinner, fox hunts, a mobile rally, trade displays, and all the fun of similar events in your country.

Old-Timers Club 50-year certificates were awarded recently to Derek Thomson ZL1KB, John Mackie ZL2JT, Gordon Bowman ZL3BH, Stan Cook ZL2QQ, Bill Masters ZL2LY, Gordon Crocker ZL1KR, and Stu Murray ZL1KS; 60-year certificates went to Eric Beale ZL2AT and Noel Gardiner ZL2BNI.

It is with regret that I have to report the following Silent Keys over the past couple of months: ZL3UD, ZL2JF, ZL1HW, ZL4IB, ZL3ABX, and ZL1AHX.

POLAND

Jerzy Szymczak
78-200 Bialogard
Buczka 2/3
Poland

TRANSITIONS

The first President of the Polish Radio Amateurs Association, Prof. Dr. Janusz Groszkowski, died on September 3, 1984. He was elected the President of PRAA at the first constitutional congress of PRAA in February, 1930. During the second world war he deciphered the radio-control system of German missiles. Prof. Janusz Groszkowski was decorated with the Honorary Award of PRAA, No. 1, and bore the title of Honorary Member of the Association. The architect of Polish radio engineering, a member, and in 1963-1973 the President of the Polish Academy of Sciences, he was always an ally of Polish radio amateurs.

The Vice-President of PRAA in charge of technical matters, Jerzy Niewada SP7HF, has died. At a meeting of PRAA it was decided not to appoint anybody to that post. The Technical Commission of Headquarters takes over responsibility for technological progress and new projects.

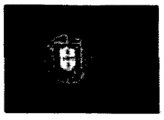
The Vice-President of PRAA in charge of organization matters, SP4BBU, has resigned but he continues in the Presidium. Wiktor Chojnacki SP5OU took over the duties of SP4BBU.

In the last report the discussions about the adoption of a new statute of PRAA were mentioned. Debaters at district conventions of PRAA expressed positive opinions of the existing statute. However, the Organization Commission of Headquarters of PRAA put forward an initiative of the statute modifications at a meeting in July, 1984, for later action by the National Congress.

Drafts of a new order of the Ministry of Communications relative to amateur radio's communications service and new directions of State Radio Surveillance were discussed at the meeting of Presidium of PRAA. Remarks on the documents were sent to Legal Department of the Ministry of Communications. New hopes or new stresses?

District Verification Boards ended their activities. Till 22 June 1984, 4586 individual licenses (60% of number from before 13 December 1981) and 410 permissions for club stations (50%) were handed over. Former hams that arrive at a decision to return to the ether must submit an application as if making a request for the first time.

After a time lag of several years, the Interdepartmental Club of PRAA in Jaroslaw organized the sixth meeting of Polish radio amateurs. 90 Polish hams from different parts of Poland, mainly prize winners of this year's Radio Amateurs' Activity Days, could become personally acquainted with each other—without the medium of radio waves. The following winners of Activity Days were honored with cups at the meeting: Jan Switalski SP8MJ, Jaroslaw Plesnik OK2BSP, Club SP8BVK from Zamosc, Club SP8KAR from Rzeszow, Stanislaw Stuliglowa SP8BVK, Henryk Jaroszek SP5XD, and Andrezej Merker SP-0176-WA. The current problems of common interest of Polish hams, namely organization and publishing dilemmas, were placed on the agenda. Commodity exchange had a great vogue. Organization of the meeting that took place in July, 1984, came up every minute. It's an ill wind that blows nobody any good!



PORTUGAL

Luiz Miguel de Sousa CT4UE
PO Box 32
S. Joao do Estoril 2765
Portugal

Hi folks!

Our local administration has been promoting periodic meetings with a few ham associations in which were discussed several interesting matters for the ham service in general. During the past months, the subjects discussed were mainly around the VHF and UHF repeaters, considering the IARU recommendations. The committee took into account the deficient coverage of the existing repeaters; in order to clear this complicated system, we should have installed more regional and local repeaters.

Another interesting thing is the issuing of callsigns in the future. They will be given according to the category of operator as well as the living area, or postal code. For example: Class A—prefix CQ, Class B—prefix CR, Class C—prefix CS, Class D—prefix CU, and Macau (ex CR9), prefix XX. The owners of current calls may keep them if they like.

Following the first two letters, we will have a number that corresponds to the first digit of the postal code (except for the ones in the Azores, CT2, and Madeira islands, CT3, where the numbers are the same). Hams in Macau have already had the XX9 call for some time.

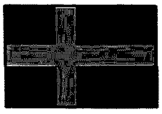
The *Portuguese Radio Amateur's Callbook* for 1985 was distributed free of charge to all licensed hams in this country. It happened last January. On this project were involved several Associations (such as those from Beira Alta, Amadora e Sintra, Estoril, and Algarve), some private companies, and, finally, the local administration who supported the mail charges and gave the update addresses for the *Callbook*. The editor is Nelson Alves CT1MV. In this useful book are listed all the resident hams in Portugal CT1/4 (mainland), Azores CT2, and Madeira CT3.

With easy access to microcomputers, the two modes of RTTY and SSTV are not as complicated as they were some years ago. (No one could sleep when I had my old Teletype Mod. 15 on receive mode—hi.)

So, in the DX frequencies, you may hear a few CTs on RTTY and SSTV, using microcomputers and interfaces. The most popular computer that we have is the Sinclair Spectrum (assembled here), but we also have the Dragon, Texas TI99/4A, VIC-20, and Commodore C-64.

I've just received an interface AIR-1 for my C-64, and I'm rather active, too. If you hear me, give me a call and I will buy you a drink when you come over to Portugal.

That's all folks, until next month.



SWEDEN

Rune Wande SM0COP
Frejavagen 10
S-155 00 Nykvarn
Sweden

SM5LN—SILENT KEY

Martin Hoglund SM5LN died in Stockholm on December 21, 1984, after a few months of illness.

Martin devotedly and voluntarily did most important work for the Swedish radio amateurs. During the last 25 years, he was a staff member of the Swedish amateur radio league, SSA. Over the last 20 years he was in charge of both the SSA office and the league's finances. This work is not very glamorous but of the utmost importance. Martin did all this work for SSA in his spare time.

Martin was born in 1920 on the island of Gotland (SM1) but lived most of his life in the city of Stockholm where he was employed by the Ericsson Radio Systems AB. On the radio, he was mostly on the 80 meter band chatting with local friends. Other interests included Egyptian history in which he was notably knowledgeable. SSA and its members have lost a dedicated radio amateur and a good friend who never will be forgotten.

SSA HAM FESTIVAL

This year the SSA Annual Membership Meeting will be hosted by the club NSRA, Nordvastra Skanes Radioamatorer—SK7DD—in the town of Helsingborg on the last weekend of April. Helsingborg is one of the ports when you are leaving Sweden for the European continent. A ferry takes you to Helsingor in Denmark in half an hour. This festival will be a remarkable one. Helsingborg celebrates its 900-year anniversary, SSA its 60th, and NSRA its 40th. With all the attractions NSRA is planning for, this will be a great weekend for all radio amateurs getting together, of which many certainly will be coming from neighboring Denmark.

WASM-60 AWARD

This award is offered by the SSA (Sveriges Sandareamatorer) to celebrate its 60th anniversary in 1985. The award is available to all licensed radio amateurs and SWLs. All contacts between January 1, 1985, and December 31, 1985, are valid.

Requirements:

HF: European applicants should work one station in each of the 25 Swedish lan (counties). Non-European applicants should work one station in each of the eight Swedish call areas (SK/SL/SM: 1, 2, 3, 4, 5, 6, 7, 9).

VHF: Applicants should work one station in each of the eight Swedish call areas.

Contacts via satellite are valid but not contacts via active repeaters. Endorsements are available for single band and single mode.

Special-event stations count as jokers and each one may replace one missing lan or call area.

The award is free of charge. Verified log entry is to be sent to: WASM-60 Award Manager, Bengt Hogkvist SM6DEC, Blabarstigen 11 B, S-546 00 Karlsborg, Sweden.

Swedish lan (counties):

A	(SM9, SM5)	O	(SM6)
B	(SM9, SM5)	P	(SM6)
C	(SM5)	R	(SM6)
D	(SM5)	S	(SM4)
E	(SM5)	T	(SM4)
F	(SM7)	U	(SM5)
G	(SM7)	W	(SM4)
H	(SM7)	X	(SM3)
I	(SM1)	Y	(SM3)
K	(SM7)	Z	(SM3)
L	(SM7)	AC	(SM2)
M	(SM7)	BD	(SM2)
N	(SM6)		

HAM HELP

This is not technical, but nevertheless something this ham needs help with! For years, an old and incomplete jingle has frustrated me—I wonder if any of you readers can help complete the missing verses?

Ten Thousand Swedes
Crawled through the weeds
At the battle of Copenhagen.
< What goes here?>
Pursued by one Norwegian!

I would be surprised to hear from any Swedish folk, unless the tide of battle changed!

M. McDaniel W6FGE
940 Temple St.
San Diego CA 92106

I need any information I can get on a Monsanto 6400 A oscilloscope. I will gladly pay copying charges.

John Anderson N7GGO
PO Box 1145
Shelton WA 98584

DEALER DIRECTORY

Culver City CA

Jun's Electronics, 3919 Sepulveda Blvd., Culver City CA 90230, 390-8003. Trades 463-1886 San Diego, 827-5732 (Reno NV).

Fontana CA

Complete lines ICOM, DenTron, Ten-Tec, Mirage, Cubic, Lunar, over 4000 electronic products for hobbyist, technician, experimenter. Also CB radio, land-mobile. **Fontana Electronics, 8628 Sierra Ave., Fontana CA 92335, 822-7710.**

San Jose CA

Bay area's newest amateur radio store. New & used amateur radio sales & service. We feature Kenwood, ICOM, Azden, Yaesu, Ten-Tec, Santec & many more. **Shaver Radio, Inc., 1775A S. Winchester Blvd., Campbell CA 95008, 370-6665.**

New Castle DE

Factory Authorized Dealer! Yaesu, ICOM, Ten-Tec, KDK, Kenwood, AEA, Kantronics, Santec. Full line of accessories. No sales tax in Delaware. One mile off I-95. **Delaware Amateur Supply, 71 Meadow Road, New Castle DE 19720, 328-7728.**

Preston ID

Ross WB7BYZ has the largest stock of amateur gear in the Intermountain West and the best prices. Call me for all your ham needs. **Ross Distributing, 78 So. State, Preston ID 83263, 852-0830.**

Littleton MA

The reliable ham store serving NE. Full line of ICOM & Kenwood. Yaesu HTs, Drake, Daiwa, B&W accessories. Curtis & Trac keyers. Larsen, Hustler, Telex/Hy-Gain products. Mirage amps., Astron P.S., Alpha Delta protectors, ARRL & Kantronics instruction aids. Whistler radar detectors. Full line of coax fittings. **TEL—COM Electronic Communications, 675 Great Rd. (Rt. 119), Littleton MA 01460, 486-3400/3040.**

Derry NH

Serving the ham community with new and used equipment. We stock and service most major lines: AEA, Astron, Azden, B&W, Cushcraft, Hy-Gain, Hustler, ICOM, Kenwood, KLM, Larsen, Mirage, Mosley; books, rotors, cable and connectors. Business hours 9–7 Monday through Thursday, and 9–5 Friday and Saturday. **Rivendell Electronics, 8 Londonderry Road, Derry NH 03038; 434-5371.**

Albany, New York
UPSTATE NEW YORK

Kenwood, ICOM, Ten-Tec, Belden, Cushcraft, Larsen, Hustler, ARRL, Hy-Gain, B&W, MFJ, Mirage. New and used equipment. Serving the amateur community since 1942. **Adirondack Electronics, Inc., 1991 Central Avenue, Albany NY 12205, 456-0203** (one mile west of Northway exit 2W).

Columbus OH

The biggest and best ham store in the Midwest featuring Kenwood and other quality products with working displays. We sell only the best. Authorized Kenwood service. **Universal Amateur Radio, Inc., 1280 Aida Dr., Reynoldsburg (Columbus) OH 43068, 866-4267.**

Dallas TX

IBM PC/XT kits, supplies, expansion products; video restorer kits for pay TV, CATV, satellite hobbyists' electronic project kits/appnotes. More than 9000 parts in stock: semiconductors, ICs, discretes, video accessories, tools, audio, automotive, cabinets, computer peripherals. Please write for your free 60-page catalog: **Sabet Electronics, 13650 Floyd Rd., Ste. 104, Dallas TX 75243; 783-4950 (formerly I.E.).**

DEALERS

Your company name and message can contain up to 25 words for as little as $150 yearly (prepaid), or $15 per month (prepaid quarterly). No mention of mail-order business or area code permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the August '85 issue must be in our hands by June 1st. Mail to 73 Magazine, Peterborough NH 03458. ATTN: Nancy Ciampa.

PROPAGATION

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA						20	20					
ARGENTINA	20	20	20	40			20	20	15	15	15	15
AUSTRALIA		20	20	20	40	40	20					
CANAL ZONE	15	40	40	40	40[1]	40		15	15	15	10	10
ENGLAND			40[1]	40			20	20	20	20	20	20
HAWAII			20		40		20					
INDIA												
JAPAN						20	20					
MEXICO	15	40	40	40	40[1]	40		15	15	15	10	10
PHILIPPINES							20					
PUERTO RICO	15	40	40	40	40[1]	40		15	15	15	10	10
SOUTH AFRICA			40	40		20	20				20	
U.S.S.R.							20	20		20		
WEST COAST	20	40	40	40[1]	40[1]	40						20

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA		20	20					20	20			
ARGENTINA	15	20	20	40			20	20		15	15	15
AUSTRALIA	15	20	20	20	40[1]	40		20			20	
CANAL ZONE	15	20	20	20	40[1]	40	20	20	15	15	15*	10
ENGLAND	20	40					20	20		20	20	20*
HAWAII	15	15	20	20	20	40	20	20				
INDIA												
JAPAN		20	20					20	20			
MEXICO	15	20	20	20	40[1]	40	20	20	15	15	15*	10
PHILIPPINES		20	20				20	20				
PUERTO RICO	15	20	20	20	40[1]	40	20	20	15	15	15*	10
SOUTH AFRICA							20				20	20
U.S.S.R.								20			20	

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA		20	20						20			
ARGENTINA	15	20	20	40	40			20	20		15	15
AUSTRALIA		20	20	20	20	40[1]	40[1]		20		15	15
CANAL ZONE	15	15	20	20[1]	40[1]	40		20	20	15	15	15
ENGLAND	20							20	20			20
HAWAII	20	15	15	20	20	20[1]	40[1]	40	20		20	20
INDIA				20					20			
JAPAN		20	20						20			
MEXICO	15	15	20	20[1]	40[1]	40		20	20	15	15	15
PHILIPPINES				20					20			
PUERTO RICO	15	15	20	20[1]	40[1]	40		20	20	15	15	15
SOUTH AFRICA			40						20			
U.S.S.R.									20			
EAST COAST	20	40	40	40[1]	40[1]	40						20

1 = Possible 80-meter openings.
*** = Check next higher band.**

G = Good, F = Fair, P = Poor.

MAY

SUN	MON	TUE	WED	THU	FRI	SAT
			1 G	2 G	3 G	4 F
5 P	6 F	7 G	8 G	9 F	10 P	11 P-F
12 F	13 G	14 G	15 F-P	16 P-F	17 G	18 G
19 F	20 P	21 P	22 F	23 G	24 G	25 F
26 P	27 F	28 G	29 G	30 G	31 G	

Issue #297

OUR 25th ANNIVERSARY YEAR!

June 1985
$2.50 USA
$3.50 Canada

73 for Radio Amateurs

A CWC/P Publication

International Edition

SPECIAL ISSUE: The New RTTY!

9N1MM Update

Secrets of Telehamming

Is Your Rig A Health Hazard?

73 for Radio Amateurs®

ISSUE #297 JUNE 1985

On the Cover:
Model 15 courtesy of Alan Brown Sr. W1VTP. Tono EXL-5000E courtesy of Amateur-Wholesale Electronics, Miami. Photography by Ed Judice, Orange MA.

4 **What?**
7 **QRX**
56 **Barter 'N' Buy**
57 **Special Events**
61 **Satellites**
62 **Fun!**
63, 83, 87 **Ham Help**
65 **New Products**
66 **Review**
69 **Be My Guest**
70 **RTTY Loop**
70 **DX—9N1MM**
80 **Contests**
86 **Letters**
88 ***73* International**
93 **List of Advertisers**
94 **Dealer Directory**
94 **Propagation**

14 Tune In the TU-1000
Has your RTTY budget hit bottom? Then dust off that soldering iron—K9EUi's no-nonsense terminal unit gives store-bought performance at a build-it-yourself price. K9EUI

24 Secrets of Telehamming
When the bands are dead, try trading your transmitter for a telephone. Operators are standing by. K9EI

26 CoCo's Counter
Use this dirt-cheap method to tune up your AFSK generator. KG4Q

28 Is Ham Radio Baking Us?
What damage occurs when human bodies are subjected to electromagnetic fields is not fully understood. Here, an expert in biostatistics examines the problem from an amateur's perspective—and offers some practical preventative suggestions. VE3KSP

32 AFSK, And Ye Shall Transceive
A sine from heaven is what you'll get when you build the AFSK-1020. ... K9EUI

34 Through the Looking Glass
If you could peek at a RTTY signal through magic audio glasses, what would you see? You'll find out with KN4L's Apple opus, a program that whispers, "Run me." KN4L

36 Perfection Plus
It's not often a prize-winning package can be improved. Here's a new look for a popular RTTY tuner. W1PDI

40 Speak-No-Evil RTTY
This tiny routine is all you need to transform your Heath H-8 into a RTTY receiving demon! WA6NHC

42 On the Flip Side
Here's how to add reverse shift to your Kantronics Interface. K1QPS

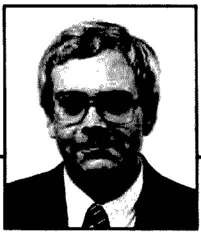
44 Quash QRM
Add a "RTTY Narrow" position to your TS-520's mode switch—you'll never copy hits again! KA4MTO

46 The D-Day Demodulator
When the CV-89A joins forces with your micro, you'll take the RTTY bands by storm! WB5LLM

50 Slick VIC Trick
Here's the cheapest way we know of to add a printer to your VIC-20. First, find a Model 33 ... . KW9L

54 QSK for Your Vintage Vfo
All it takes is an hour. KA3GCQ

Editorial Offices: Pine Street, Peterborough NH 03458, phone: 603-924-9471. **Advertising Offices:** Elm Street, Peterborough NH 03458, phone: 603-924-7138. **Circulation Offices:** Elm Street, Peterborough NH 03458, phone: 603-924-9471 **Manuscripts:** Contributions in the form of manuscripts with drawings and/or photographs are welcome and will be considered for possible publication. We can assume no responsibility for loss or damage to any material. Please enclose a stamped, self-addressed envelope with each submission. Payment for the use of any unsolicited material will be made upon acceptance. All contributions should be directed to the *73* editorial offices. "How to Write for *73*" guidelines are available upon request. US citizens must include their social security number with submitted manuscripts. **Subscription Information:** Rates: in the United States and Possessions: One Year (12 issues) $24.97; Two Years (24 issues) $38.00; Three Years (36 issues) $53.00. Elsewhere: Canada and Mexico—$27.97/1 year only, U.S. funds. Foreign surface mail—$44.97/1 year only, U.S. funds drawn on U.S. bank. Foreign air mail—please inquire. To subscribe, renew or change an address: Write to Subscription Department, PO Box 931, Farmingdale NY 11737. Send Canadian changes of address to: 73, PO Box 1051, Fort Erie, Ontario CANADA L2A 5N8. Return postage guaranteed. For renewals and changes of address, include the address label from your most recent issue of *73*. For gift subscriptions, include your name and address as well as those of gift recipients. For questions concerning your subscription and to place subscription orders, please call us toll free at 1-800-645-9559 between 9 am and 5 pm or write to *73*, Subscription Department, PO Box 931, Farmingdale NY 11737. *73 for Radio Amateurs* (ISSN 0745-080X) is published monthly by CW Communications/Peterborough, Inc., 80 Pine Street, Peterborough NH 03458. Second class postage paid at Peterborough NH 03458 and at additional mailing offices. Canadian second class mail registration number 9566. Microfilm Edition—University Microfilm, Ann Arbor MI 48106. Postmaster: Send address changes to *73*, Subscription Services, PO Box 931, Farmingdale NY 11737. Nationally distributed by International Circulation Distributors.



WHAT? News from the Publisher

What you'll notice right away is that we no longer have a "Never Say Die" column. Wayne is not dead or dying. He simply resigned his writing responsibilities. This is not a case of "so-and-so resigned" meaning "so-and-so was 'asked' to resign." No way. I got a note from Wayne dated 4/5/85. In part, it said, "My loss of interest in *73* is no secret...list me as founder and let's end the charade that I'm the editor." Saturday morning, April 13, I went up from where I live to where Wayne does (.8 miles). "Is there anything you'd like me to pass along to our readers about you quitting writing—anything at all?" No. "Nothing, you're sure?" Nothing. And then he started talking with an old friend about amateur radio and *73* and how he had been the first person on the air from our shack on Ham-Day, March 24th. He was. Is it say never write or Never Say Die? Time will tell. Wayne is not connected with *73* in any official way—nor has he been for some time—but his page is always here if he wants it.

Three Notes:

1) A reader from Erie, Pennsylvania, wrote: "...this is a first for me. But I nearly didn't write because of your seventh point concerning mail (April "What?"; mail up 14%). I hope this does make it..." It did. They all do. Let's go for 20%.

2) A potential advertiser from a different time zone recently called me at home (which is perfectly OK). I was running late and about 24 minutes away from playing in a basketball playoff game. The phone rang. I picked it up. He said, "Hi, Jack..." I cut him off: "Hi, (Blank), I can't talk right now, I'm on my way out the door." When we next talked, (Blank) seemed a little bit subdued. "What's the problem?" I asked. "Well," he said, "you said you were out the door. Who can I deal with now?" We got the nuances of doors straightened out.

3) A call came in from a nice lady who needed "one of those ham radios." Could we help her? "If you don't mind me asking, why do you need one of these ham radios?" Well, it turned out that she wanted to get a rig for her OM for his birthday. He had been out of amateur radio for some time, but now he wanted to get back in. She had had to wait until he went out of town on business in order to make sure he was totally surprised. We put her in touch with a dealer in her area and wished her the best of luck. "Now," I said, "I suppose you're going to tell me that his birthday is tomorrow." "Yes, yes, and thank you so very, very much for your help!" "Well, that's what we're here for." I felt a little bit stupid saying that, but in retrospect I'm not sorry I did. Helping people out IS what we're here for.

Jack Burnett

STAFF

EXECUTIVE EDITOR
Susan Philbrick

MANAGING EDITOR
Steve Jewett KA1MPM

TECHNICAL/INTERNATIONAL EDITOR
Perry Donham KW1O

EDITORIAL ASSISTANTS
Nancy Cook
Richard Phenix
Chris Schmidt KA1MPL

DESIGNERS
Diane Ritson
Linda Drew

ASSOCIATES
Robert Baker WB2GFE
John Edwards KI2U
Bill Gosney KE7C
Chod Harris VP2ML
Dr. Marc Leavey WA3AJR
Bill Pasternak WA6ITF
Peter Stark K2OAW

ADVERTISING
1-800-441-4403

SALES MANAGER
Jim Gray W1XU

ASSISTANT SALES MANAGER
Nancy Ciampa

SALES REPRESENTATIVE
Ross Kenyon KA1GAV

MARKETING MANAGER
Hope Currier

GRAPHIC SERVICES DIRECTOR
Christine Destrempes

GRAPHIC SERVICES MANAGER
Dennis Christensen

MANUFACTURING MANAGER
Susan Gross

PRODUCTION SUPERVISOR
Dawn Matthews

FILM PREP SUPERVISOR
Robert M. Villeneuve

TYPESETTING SUPERVISOR
Linda P. Canale

PRESIDENT
Debra Wetherbee

VICE PRESIDENT/FINANCE
Roger Murphy

ASSISTANT GENERAL MANAGER
Matt Smith KA1IEI

ASSISTANT TO VP/FINANCE
Dominique Smith

DIRECTOR OF CIRCULATION
William P. Howard

CIRCULATION MANAGER
Frank Smith

DIRECT AND NEWSSTAND SALES MANAGER
Raino Wirein
1-800-343-0728

DIRECTOR OF CREDIT SALES AND COLLECTIONS
William M. Boyer

FOUNDER
Wayne Green W2NSD/1

PUBLISHER
John C. Burnett

Bash QRT

DICK BASH KL7IHP has closed the doors on his amateur-radio publishing business. Dick is probably one of the best-known figures in ham radio, and opinions of him are rather sharply divided between the "love him" and "hate him" camps. Before the VEC program came to fruition, it was common to hear comments like, "He really Bashed that test!" around the FCC examination room. Dick's *The Final Exam* study books included a verbatim listing of the questions and answers found on the FCC exams. Many hams felt that the books encouraged memorization rather than understanding of the theory and regulations, and they blamed Bash for everything from CB radio to the declining sunspot cycle. Others pointed out that the study guides were strikingly similar to those published for would-be pilots, engineers, and steam fitters and bore a strong resemblance to guides published for many years by the ARRL. Now that the VEC program is under full steam and the entire pool of questions is in the public domain, Dick says he has "nothing to sell." Like him or not, Dick Bash has left a permanent mark on amateur radio.

VEC Three

A THIRD NATIONAL VEC has been appointed by the FCC. **The DeVry Amateur Radio Society,** since the beginning a VEC in the 9th call area, has expanded its operation to encompass all United States call areas. DeVry professor **Jim Georgias W9JUG** says that their program offers "an alternative based on experience in electronics education and a long dedication to amateur radio." You can contact Jim at (312)-929-8500 for complete details.

Creme de la Ham

1985'S HAM OF THE YEAR was honored recently at the Dayton Hamvention. **John Willig W8ACE/4** received his award at the annual Saturday-night banquet, with over 800 fellow amateurs looking on. Known as "Mr. Hamvention," it was John who, in 1951, came up with the idea of putting on a little hamfest in Dayton, Ohio. This year's Special Achievement Award went to **Judy Frye KG8P** for her efforts in establishing the all-volunteer amateur examination program. Judy is responsible for many of the methods and procedures used and was cited by Senator Barry Goldwater as one of the key individuals responsible for the initial success of the program. **Rich Whiting W0TN** was the recipient of the Technical Excellence Award for his work in developing the Teleconference Radio Network (TRN). TRN is an on-the-air forum using teleconferencing technology that allows thousands of amateurs to participate in discussions with notable figures and experts in the field of ham radio. *73* congratulates John, Judy, and Rich for their tireless efforts to better our hobby.

China Chat

SIGNALS FROM CHINA will be heard on June 15th as a group of hams on tour pay a visit to BY1PK. Plans call for operation from 8:30 am to 11:30 am Beijing time. Activity in China is really picking up, with new stations popping up almost weekly now. The operators are learning to work the pileups, though most BY hams prefer to have a casual rag-chew. Don't be surprised if someone in Beijing answers your next CQ!

Space Balk

NASA HAS DISALLOWED any modification to the Space Shuttle's cargo bay to accommodate a ten-meter antenna, severely limiting the planned ham-in-space flight of **Dr. Tony England W0ORE** and **John-David Bartoe W4NTZ.** The ten-meter SSTV experiment has been scrapped, but some two-meter slow-scan will be attempted using the window antenna and Motorola HT that Owen Garriott W5LFL carried on his historic flight. Tony has decided to emphasize the educational aspects of ham radio and will spend most of his limited operating time contacting radio clubs and schools. The ARRL is acting as a clearinghouse for organizations wishing to participate. Several delays have set the orbiter's scheduled launch back to mid-July; next month's column will contain the latest flight plan, or you can access the *73* RBBS at (603)-924-9809 for up-to-the-minute information.

Hamtastic!

HAM DAY '85 filled a few pages in the log here at W2NSD/1. The crew at *73* was on the air nearly all day, manned by **Perry Donham KW1O, Chris Schmidt KA1MPL,** and, of course, **Wayne Green W2NSD** himself. Visitors to the shack included **Nancy Cook,** her daughter **Rachel,** and **Hope Currier.** From the letters we've received, Ham Day introduced thousands of people to the magic of amateur radio through individual demonstrations. We'll soon be hearing a flood of new calls on the bands!

Rules Revised

FIELD DAY RULES have been modified to allow additional bonus points for packet-radio contacts. The ARRL Contest Advisory Committee, acting on a request by **Thomas Clements III W1ICH,** quickly approved a 100-point reward for completing at least one packet QSO. You may add the following to your Field Day rules: "An additional 100 points can be earned by completing at least one QSO on packet radio during the Field Day period. The repeater provision is waived for packet-radio QSOs. A packet station does not count as an additional transmitter. On the summary sheet, show packet radio as a separate band." Field Day will be held the 22nd and 23rd of June—look for the *73* gang on the air as W1XU!

Leaky Lines

THE ARRL has strongly opposed FCC Mass Media Docket 85-38, which seeks to relax quality standards for cable-television systems, allowing larger signal leakage levels in the 54-216-MHz band. In its comments, the League stated, "it would appear that the proposed increase in maximum cable signal leakage levels is unnecessary to well-engineered, well-maintained systems. . .Only those systems which exhibit leakage levels in excess of presently permitted leakage maxima would be rewarded for their failure to adequately maintain their systems by legalization of existing rule violations." The ARRL pointed out that they receive between 4 and 10 communications weekly from amateurs requesting technical assistance with regard to cable-TV interference. During a hearing in which FCC Chairman Fowler went before the Senate Subcommittee on Communications, Senator Goldwater asked Chairman Fowler about the proposed legislation, and whether cable-television operators would still be responsible for eliminating interference, regardless of the level of leakage from the cable. Fowler's reply: "Absolutely!"

Code Convicts

NATIONAL VEC W5YI has been notified of what may be the first documented case of cheating on a volunteer-administered examination. Lakeville, Indiana, VE, **Larry Weaver KB9V,** reports that his VE team ob-

served two testees scribbling gibberish on their exam papers during the Morse-code portion of the session. Later, the pair turned in sheets with perfect scores—for the previous month's test! When approached, one of the applicants bolted for the door, Form 610 in hand. The other confessed that a third accomplice had secretly taped the earlier exam with a microcassette recorder. The FCC's Compliance Branch is looking into the matter.

Sat Session Set

AMATEUR SATELLITES will be the topic of the next North American Teleconference Radio Net (TRN), scheduled for June 14th. An overview of the OSCAR program will be presented, including information on how to get started in satellite communication, how amateur satellites are launched and built, and what kinds of plans are on the drawing board for future OSCARs. Featured speakers for this TRN include **John Browning W6SP**, **Rip Riportella WA2LQQ**, **Tom Clark W3IWI**, **John Champa K8OCL**, and **Bill Tynan W3XO**. This is a good opportunity to pick up the information you need to get started in this exciting phase of amateur radio. For information about TRN, contact Net Manager Timothy Lowenstein, c/o Midway Amateur Radio Club, PO Box 1231, Kearney NE 68847-1231.

QRM?

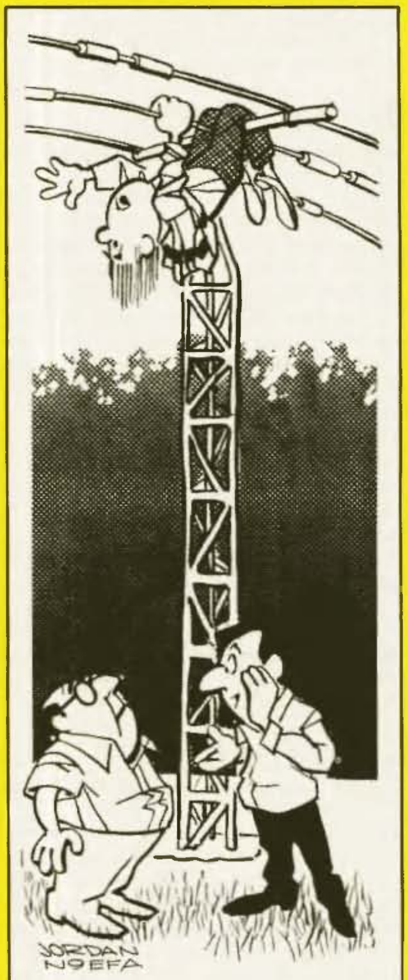
A REPORT AND ORDER issued by the FCC recently allows commercial broadcast stations licensed by the FCC and operating in the Pacific outside of ITU Region 2 (North America, South America, and Greenland) to transmit on frequencies between 7100 and 7300 kHz. The Order stipulates that none of the stations may operate at any time with their antennas aimed at Region 2. It also sets limits on the amount of radiated energy that is allowed to leak into Region 2 during the hours from 0800 to 1600 UTC: 12 dB below the major lobe for antennas with gains greater than 15 dB, and 6 dB below the major lobe for antennas of less than 15 dB gain. It's not clear yet just how much extra interference this will cause on the already congested 40-meter band.

Forty Phone

CARIBBEAN AMATEURS soon will be able to use phone in the 7075–7100-kHz band. Hams in Alaska and Hawaii already have this privilege. A petition filed last November by **David Novoa KP4AM** noted that the Caribbean is the only FCC jurisdiction outside of the continental US where amateurs may not operate in this segment. David said that interference from broadcast stations makes frequencies above 7100 kHz useless at night. He further reasoned that use of 7075–7100 kHz would promote international goodwill and would not interfere with CW operation stateside. The FCC proposes to amend Section 97.61, paragraph 1, limitation 1 to read, "The use of **A3E** and F3E in this band is limited to amateur radio stations transmitting from any location other than the forty-eight contiguous states." The Puerto Rico Amateur Radio Club suggests limiting the privileges to Advanced- and Extra-class licensees. Comments on the proposed rulemaking, Docket 85-104, are due by June 17, while reply comments should be in by July 17.

Packet Prize

A UNIQUE AWARD is being offered by the **Pacific Packet Radio Society (PPRS)** to encourage packet-radio enthusiasts to stretch the limits of digital communication. The "Golden Packet" will be presented to amateurs who complete the first terrestrial transcontinental packet network link and will consist of either a plaque or certificate suitably engraved for all of the participating stations. The system used for the transcontinental link must consist of fixed terrestrial digital store-and-forward radio links using VHF (greater than 144.1 MHz), UHF, or microwave frequencies. Use of HF, satellite, tropo, meteor scatter, or moonbounce is prohibited. For complete details, contact the Pacific Packet Radio Society, PO Box 51562, Palo Alto CA 94303.



I'd help Ralph get down but he's giving me a 1:1 swr!

Sudden Move

ALABAMA REPEATER OWNERS were surprised by a letter from Frequency Coordination Chairman **William Matthews WA4ZVJ** directing them to comply with a 20-kHz repeater spacing two-meter band plan by July 1, 1985, or lose their coordinated status. According to a story in the *W5YI Report*, Matthews wanted Alabama to switch to the new band plan first, setting an example for neighboring states Georgia, Tennessee, Mississippi, and Florida. An Alabama repeater owner claims that he "had heard nothing until a registered letter showed up saying that I had to move." There seems to be no room for discussion. As one owner said, "You can say anything you want, but if you are not on the new frequency by July 1st, you can forget your repeater."

Battle Zone

AMATEURS HAVE WON a major battle in North Carolina against a restrictive antenna ordinance that would have limited the installation of amateur UHF systems. The proposal, which had been approved by the Cumberland County Joint Planning Board, would have required a permit for the erection of a "satellite dish" of greater than 42 inches in diameter and would have banned dishes with a diameter greater than 12 feet. Speaking on behalf of the Cape Fear Amateur Radio Society, **Bert VanderClute N4ERM** pointed out that amateur-radio operators often use antennas similar in appearance to satellite-television dishes. He then cited the great contribution made by hams during times of crisis, such as the communications provided by amateurs after a tornado devastated the region last year. When the dust had settled and the matter was put to a vote, the hams won 4 to 1. Overwhelming support from the amateur community and a rational, well-presented argument were the key to this victory.

Help!

WE HAD HELP this month from the *W5YI Report*, *Gateway*, the *ARRL Letter*, and Contributing Editor Bill Pasternak WA6ITF. We'd love to hear from **you**—send your news items and photographs to *73 Magazine*, 80 Pine Street, Peterborough NH 03458, Attn: "QRX."

Bob Roehrig K9EUI
314 S. Harrison Street
Batavia IL 60510

Tune In the TU-1000

Has your RTTY budget hit bottom? Then dust off that soldering iron—K9EUI's no-nonsense terminal unit gives store-bought performance at a build-it-yourself price.

The TU-1000 is a state-of-the-art terminal unit for RTTY that equals or exceeds the performance of most units available today. The design intent was to have a circuit that could be built easily. With a minimum of fuss, you can get on RTTY with the features and performance expected of commercial units:

- Tuned circuits employ the latest active-filter technology that eliminates bulky toroidal inductors and the need for hand-selecting components
- Input filtering ahead of the limiter prevents unwanted signals from reaching the limiter
- Continuously-adjustable shift from 50 to 850 Hz
- Only one internal adjustment required prior to operation and no selection of components needed
- RS-232 data output interfaces with modem terminals, microprocessors, code converters, or current-loop drivers
- RS-232 and relay driver output from autostart circuit
- Switchable low-pass post-detection filter for optimum results at different data rates
- Squelch circuit clamps data output in marking state when no data is present
- Data-invert switch for inverted input signals
- Sensitive input works off any audio source of at least 75 mV rms
- Automatic slicer bias compensates for signal fading

Circuit Description

Input stage IC1A is a combination high-pass filter and follower. It rolls off below 1000 Hz while presenting an input impedance of about 50k to the audio source. Thus it is suitable for connecting to the record output of many modem receivers as well as a speaker output. The high-pass filter provides at least 40-dB rejection to 60- and 120-Hz hum and ripple. The output of this stage presents a constant low-impedance source for the next stage.

IC1B and IC2A form high-pass and low-pass filters which act as a broad band-pass filter. This filter rejects frequencies outside the desired range. In the desired range of 2 to 3 kHz, response is flat within 1 dB. Outside this range, a 6-dB-per-octave roll-off occurs. Submultiples of this range are the frequencies that cause the most problems. Frequencies in the 700-to-1000-Hz range are attenuated at least 20 dB, preventing their harmonics from capturing the limiter.

IC2B is a limiter stage which has a gain of 1000. This stage delivers a constant amplitude signal to the active channel filters. Unlike some other TU designs, this limiter is self-biased, which eliminates the need for a touchy adjustment.

The channel filters consist of IC3 for mark and IC4 for space. These devices contain a 3-stage active filter with 2 tunable elements. By tuning both adjustable sections, the filter can be tuned over a wide frequency range and still maintain a uniform output level. Gain of the filters is set by divider R11/R12 and the filter input resistors R13 and R23. Filter Q is set by R21 and R35. The mark filter, IC3, is tuned to 2125 Hz with R14. With 2125 Hz applied to the input of the unit, adjust R14 for maximum signal at pin 15 of IC3. The peak-response signal level at the tuning-indicator points is 6 volts p-p. R27 is a dual 10k pot on the front panel and is the space tuning control, or shift control. I suggest using a pointer knob on the shift control with calibration marks on the panel for the 4 main shifts of 85, 170, 425, and 850 Hz.

The filter ICs have a fourth op-amp stage that is used with diodes CR1 through CR4 to form full-wave, absolute-value detectors. The mark-detector out-

put is a positive voltage and the space detector is a negative voltage. A small amount of filtering is provided by R18/C7 and R30/C8. The peak voltage at the filter outputs is about 3 V dc. This level is reduced to less than 1.5 volts at the summing point at the input to IC5A, so this dc-amplifier stage has been given a gain of 8 to make up for the previous signal-level reduction. The output of IC5A should be positive 10 volts on mark and negative 10 volts on space.

IC5B is a unity-gain inverter used to reverse the "sense" of the signal for "upside-down" copy with the normal/reverse switch.

Final filtering of the envelope waveform is done in IC6A. This low-pass filter is switchable for high- and low-speed data. Low speeds are 45 and 50 baud and high-speed signals are those of 74 baud and greater. (In noisy conditions, the low-speed position can be used at 74 baud with a slight increase in output distortion).

CR5 through CR8 and associated components form a circuit known as an ATC (automatic threshold corrector). This is a fancy form of capacitive coupling that automatically maintains the proper dc bias to the slicer stage when there is a level difference between the mark and space signals. It is possible to obtain perfect copy even if mark or space fades completely. I recommend switching the ATC off for unattended autostart operation and when copying multiplexed signals. This circuit has been used in TUs for a number of years and has not yet been improved upon. While use of the ATC can increase output distortion under ideal conditions, it usually is left on so that it can automatically correct the signal when conditions get bad.

IC6B is the slicer, a high-gain dc amplifier that squares up the filtered waveform. The slicer is slightly biased towards the mark side by the positive voltage from the divider formed by R54/CR9. This ensures that the TU output will idle in the marking stage when no signal is present. The slicer output is RS-232, which swings from a negative level for mark to a positive level for space. To interface to TTL circuits, you can just add a 5-volt zener diode from the output to ground, with the anode of the diode towards ground. This limits the output swing to safe limits for TTL circuits.

The output from the low-pass filter is also fed to IC7A, which sets the threshold for the autostart circuit. Like the slicer, this stage is biased towards the mark

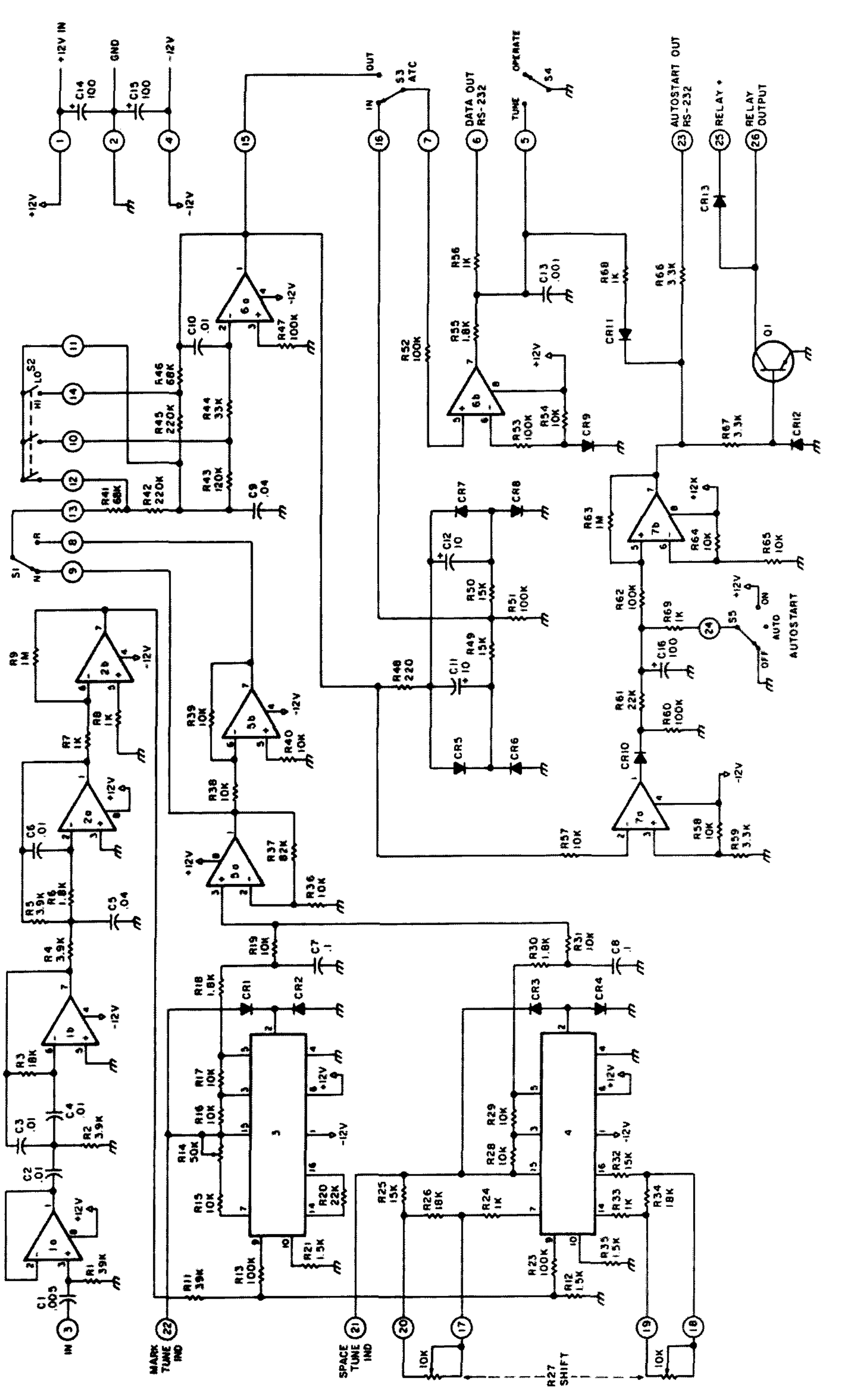


Fig. 1. TU-1000 schematic.

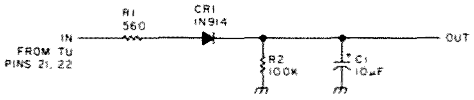


Fig. 2(a). Peak detector.

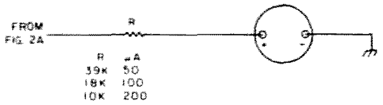


Fig. 2(c). Indicator circuit using microammeters.

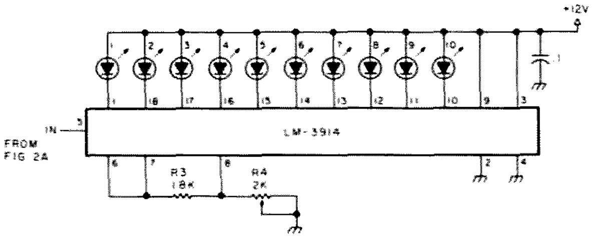


Fig. 2(b). LED indicator.

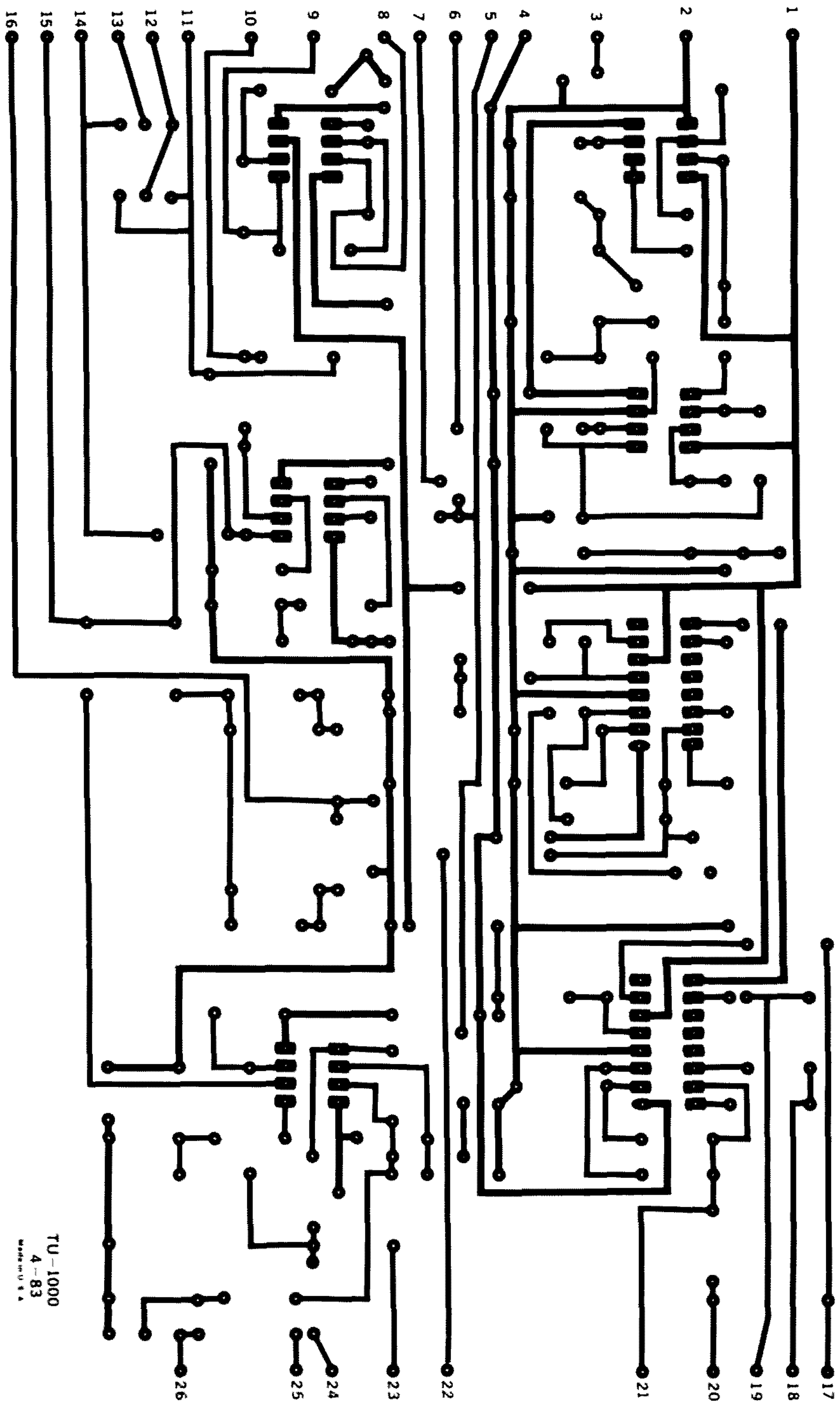


Fig. 3. PC Board, foil side.

side, only more so. This requires a fairly decent mark signal to activate the autostart. When the mark signal exceeds the 3-volt threshold, C16 will be charged via CR10 and R61. When this voltage level exceeds the 6-volt level set by R64 and R65, the output of IC7B will switch high. This output is the RS-232 autostart signal via R66. This positive level also turns on Q1, which can be used to operate a relay for motor control.

Before mark is sensed, the output of IC7B is negative. This negative source forces the data output via CR11 and R68. Spacing signals will not cause the data output to switch positive until the autostart circuit switches on. This is valuable when there is voice or other activity on the monitored frequency that would trigger the TU and cause it to print garbage. When the autostart turns on, CR11 becomes reverse biased, which permits the data output to operate normally.

When mark goes off, IC7A switches negative again. C16 slowly discharges through R61 and R60. Autostart turn-on time is determined by the RC time constant R61 × C17 and the turn-off time is (R60 + R61) × C17. With the values shown, on/off times are about 3 and 9 seconds. This ratio should be maintained so characters that have more spacing bits than marking will not cause the autostart to drop out. If you wish to change the overall timing, you can change C16. Within limits, R65 can also be changed. Reducing R65 will lengthen the times.

There are several options

for a tuning indicator. A scope may be directly connected to the indicator outputs to obtain the "cross" display. If a scope is used, it would be possible to use one of the autostart outputs to extinguish the scope beam when there are no signals to prevent a phosphor burn. Or the autostart output can connect to one of the CRT's deflection plates via a relay or high-voltage transistor to deflect the beam off the screen when the system is idle.

If you do not have a scope, I recommend one of the LED bar-graph indicator ICs like the LM3914. (A complete circuit board with LEDs included is available from Jameco.) A recommended circuit is shown in Fig. 2(b). The ac signal from the TU indicator outputs is fed to a peak detector with a fast-attack/slow-recovery time, as shown in Fig. 2(a). R3 sets the LED current at about 10 mA and R4 adjusts the sensitivity. Adjust R4 for a "full-scale" reading with steady mark and space tones on each bar-graph circuit. Remember that when a signal is tuned in and all the LEDs are on, the total current drain by both indicator circuits will be close to 200 mA.

Meters can also be used for indicators with the peak-detector circuit. I recommend 2 meters rather than a zero-center one. Try to use sensitive ones (like 200 uA or less) to reduce loading of the detector. VU meters with built-in rectifiers can be directly connected to the TU; however, they will tend to follow individual bits of the data. You will have to experiment with an appropriate value for a series resistor.

Fig. 3 is a selector-magnet driver circuit that I recommend for driving printers such as Model 15s or 28s. Ideally, this circuit should be mounted in the printer along with the 120-volt supply. This keeps the current loop physically small and reduces radiation to any receivers caused by the switching transients in the current loop. Connection to the TU should be via shielded cable to help keep out rf. Q2 does not have to be on a heat sink since so little heat is generated; it is either switched fully on or off. The Sylvania ECG-157 is also a good choice for Q2. R5/C2 suppress spikes that could damage Q2.

Performance Tests

Unlike rf or stereo equipment, there have been no real standard parameters or specifications used to compare the performance of different TUs. I decided to try to come up with some meaningful measurements that could be used.

One of the important characteristics of a TU is its ability to copy signals buried in noise. Also, if the unit has ATC, it is nice to know how well the unit does

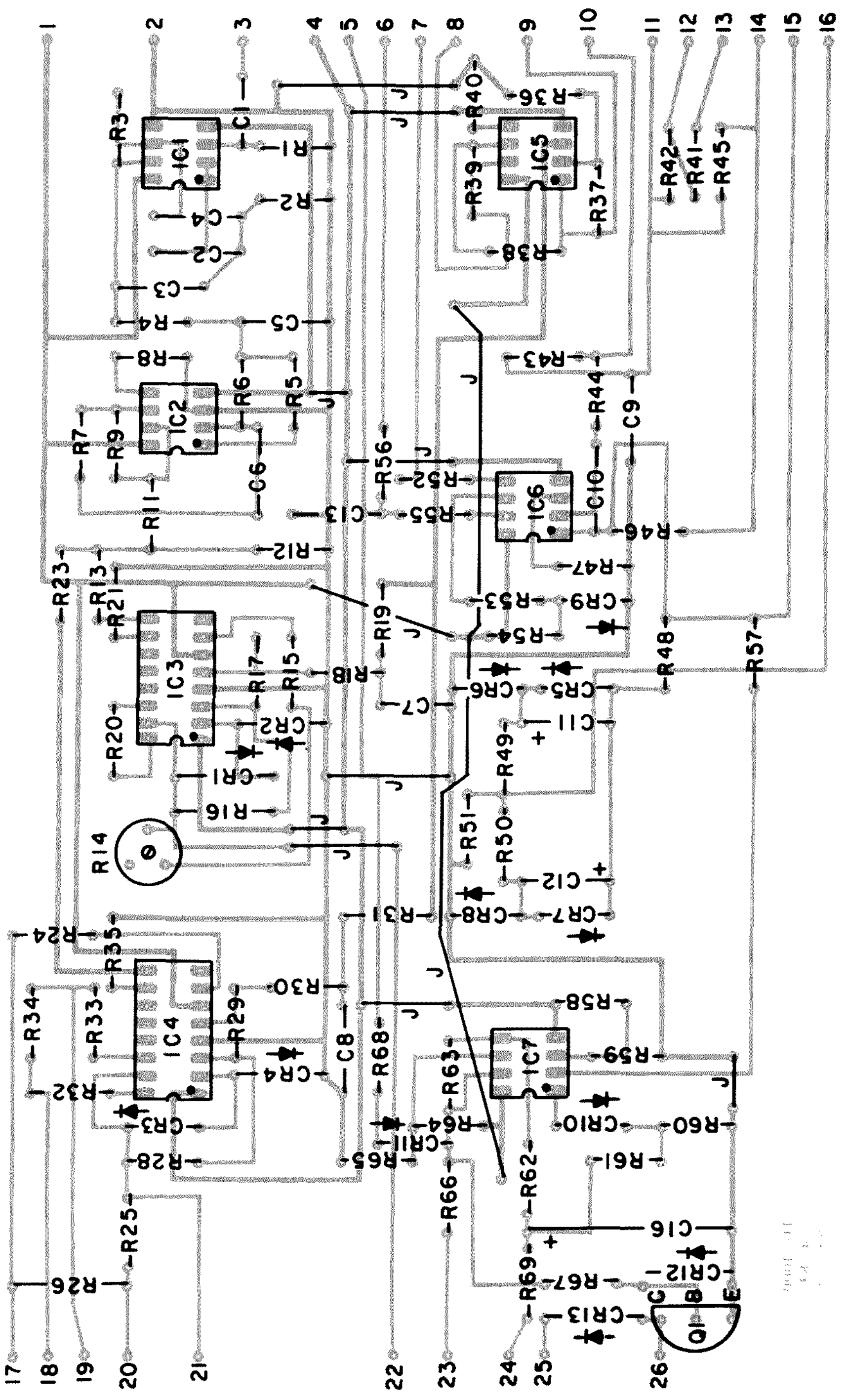


Fig. 4. Parts placement.

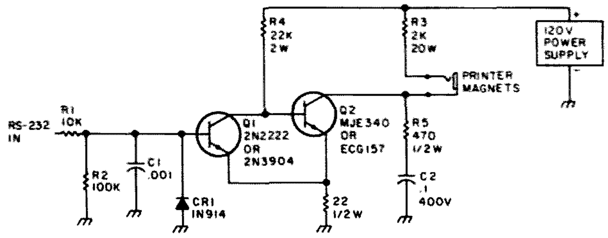


Fig. 5. Selector-magnet driver circuit.

when copying mark or space only. It is important to know how effective the post-detection filter is by determining how well it works at different data rates and how effective it is against noise.

Performance is expressed in terms of percent distortion. In TTY circuits, this means the displacement of mark-to-space or space-to-mark transitions from where they should normally occur in time in relation to the beginning of the start bit. It is kind of like checking the timing in a gasoline engine.

Wpm	Shift Hz	Noise dB*	Percent ATC Off	Peak ATC On	Distortion Mark Only (ATC On)	Distortion Space Only (ATC On)
60	170	−100	02	03	20	15
60	850	−100	02	04	06	04
60	170	0	05	06	24	17
60	850	0	05	07	11	07
60	170	+6	12	13	30	25
60	850	+6	12	15	18	15
100	170	−100	07	06	14	11
100	850	−100	02	03	06	03
100	170	0	09	10	20	16
100	850	0	06	07	14	08
100	170	+6	18	21	48	46
100	850	+6	27	24	27	24

*The noise level is in relation to the signal level. Distortion levels are peak values in one minute.

Fig. 6. Distortion readings.

In TTY distortion measurements, 50% is the maximum. Solid-state devices such as video terminals or speed converters using UARTs should provide perfect copy at distortion levels greater than 45%. A good Model 28 should provide solid copy at greater than 35%. Telegraph distortion, as it is called in the industry, is measured over one character length.

The distortion-measuring set I have indicates the type of distortion as well as the peak value over any period of time. Thus I can let the unit operate over several minutes of time and know the highest percentage of distortion that occurred over the entire time period.

The signal-source setup consists of a crystal-controlled, synthesized AFSK oscillator with less than 1% distortion. The output level was set to twice the voltage necessary to obtain limiting in the TU limiter stage. The noise source consists of a white-noise generator covering 0 to 20 kHz. The noise-generator output was set to be 20 dB higher than the oscillator output. The noise-generator output was connected to a precision attenuator that can be varied in .1-dB steps. The output of both signal sources was terminated in 600 Ohms and then summed and fed to the TU input. All levels were measured using a true rms meter. The AFSK oscillator was keyed by a commercial crystal-controlled "quick brown fox" test-sentence generator.

Measurements were made at 60 and 100 wpm, at 170 and 850 shift, and with no noise, signal and noise at equal levels, and with the noise 6 dB higher than the signal. Measurements were also made with the ATC on and off as well as with mark and space only with the ATC on. These last measurements were made by shorting across the mark or space filter capacitors, C7 or C8.

Like the mileage ratings on cars, actual performance may differ from the test results obtained. I connected

Parts List

Quantity	Value	Designation
Capacitors		
1	.001 uF	C13
1	.005 uF	C1
5	.01 uF	C2, 3, 4, 6, 10
2	.04 uF	C5, 9
2	.1 uF	C7, 8
2	10 uF	C11, 12
3	100 uF	C14, 15, 16
Semiconductors		
9	1N270	CR1–9 (or equivalent germanium)
3	1N914	CR10, 11, 12 (or equivalent silicon)
1	1N4000	CR13
5	MC-1458	IC1, 2, 5, 6, 7
2	AF-100-1CN	IC3, 4
1	2N3904	Q1 (or equivalent switching transistor)
Resistors (1/4 Watt)		
1	220 Ohms	R48
7	1k	R7, 8, 24, 33, 56, 68, 69
3	1.5k	R12, 21, 35
4	1.8k	R6, 18, 30, 55
3	3.3k	R59, 66, 67
3	3.9k	R2, 4, 5
16	10k	R15, 16, 17, 19, 28, 29, 31, 36, 38, 39, 40, 54, 57, 58, 64, 65
1	10k dual pot	R27
4	15k	R25, 32, 49, 50
3	18k	R3, 26, 34
2	22k	R20, 61
1	33k	R44
2	39k	R1, 11
1	50k pot	R14
2	68k	R41, 46
1	82k	R37
8	100k	R13, 23, 47, 51, 52, 53, 60, 62
1	120k	R43
2	220k	R42, 45
2	1M	R9, 63

The semiconductor devices are available from Jameco Electronics. Jameco also has a complete board consisting of the LM3914 and LEDs used for the tuning indicators (2 required) for $5.95 each. The AF-100-1CN ICs are $5.95 each from Jameco. (The AF-100 active-filter ICs were inadvertently left out of Jameco's 1984 catalog—they are still available from Jameco.)

Power-supply and miscellaneous components can be obtained from Radio Shack.

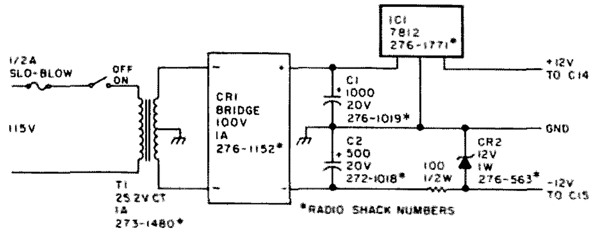


Fig. 7. Power supply for TU-1000.

the TU to my Model 28 and it printed 24 lines of quick brown foxes solid at 100 wpm with the ATC on and the noise 10 dB higher than the signal! At that ratio, the tones cannot be seen on a scope and can just barely be detected by ear.

I have not, as yet, figured a way to simulate QSB by reducing mark or space a given amount in a given time. All operation on the ham bands these days is narrow shift, so selective fading is minimal anyway. If fading is not too rapid, the ATC should handle most situations.

The distortion readings in Fig. 4 were all peak readings for 1 minute of operation. Note: There is little difference with the ATC on or off; however, the unit will not copy at all in the mark- or space-only condition with the ATC off.

As can be seen in the chart in Fig. 4, worst-case performance was measured in mark or space only, at 100 wpm 170 shift, with the noise at +6 dB. In all other cases the distortion was below 30%, which should still give solid copy. Notice that when the noise level is high, the distortion at 100 wpm is worse than at 60 wpm. This is to be expected since pulse widths of noise come closer to the pulse widths of the data bits. For this reason, high-speed data, like 1200 baud, is not practical in noisy conditions without error-correcting circuits.

All the ICs as well as the ready-made LED bar-graph indicator boards (part no. NSM3914) are available from Jameco. I can supply a 5" by 8" circuit board for the TU-1000 for $20.00; however, I have to get them made in quantities of 25. If you want a board, send me an SASE so I can let you know how long it will take. With the board I will include a parts list and layout drawing as well as a large schematic. ■

Jim Grubbs K9EI
PO Box 3042
Springfield IL 62708

Secrets of Telehamming

When the bands are dead, try trading your transmitter for a telephone. Operators are standing by.

Whether you live in the city in a one-room apartment or on a country estate that sits atop the highest ground around, there are times when it just isn't possible or desirable to set up your ham shack. Maybe you are a newcomer to the hobby and not yet licensed, but you are hungry to converse with those who are experienced in our hobby.

Whatever the limitations on your amateur-radio activities, or even if you are a quite active ham, recent developments in the computer field have made many elements of our hobby available without the need for amateur-radio equipment.

With nothing more than an inexpensive home computer and telephone modem, you can connect reliably with other amateurs regardless of propagation conditions or other factors beyond your control.

What kind of equipment does it really take? I recently purchased one of the popular Commodore VIC-20 computers with a program cassette recorder on the used market for $85. By adding a modem (computer talk for a terminal unit) and some public-domain software, I was on-line with thousands of fellow amateurs for well under $150. It doesn't take a $2000 system to get the job done!

Telecomputing (as it is often called) has its roots in the same technology as amateur RTTY. Both are a form of data communication.

Those of you familiar with RTTY may know that the teletype code consists of five levels, or bits. A start and stop signal are added for synchronization. Applying a little binary arithmetic, you can see that with only five bits to play with, only 32 different combinations are available. By defining two of these combinations as letters and figures, it is possible to squeak all of the alphabet, the numbers, and some basic punctuation into the limitations of RTTY code.

For some years now, a more versatile and expanded code has been used by many services. Known as ASCII (pronounced *Ask Key*, not *Ask Key Two*), this newer code exists in both a seven-bit and an eight-bit version. The extra combinations allow uppercase and lowercase and extended punctuation, and some graphics are possible, particularly with the eight-bit version.

If you have ever heard a RTTY signal, you know that RTTY is transmitted by rapidly shifting between two tones. Amateur standards call for these tones to be 170 Hertz apart, although other shifts are also common, particularly on commercial services.

The large bulk of amateur communications occur at the 60-word-per-minute speed. Data engineers refer to this as 45.45 baud or BPS (bits per second). The reason is simple. World War II surplus machines were made to operate at this speed.

Computer communications over telephone lines borrow heavily from this 40-year-old technology. Amateur RTTY technology can be applied directly to landline (telephone) transmissions. In fact, the TDD system (Telecommunication Device for the Deaf) still uses this technology. There are two major differences in most modern data transmission schemes.

The limitations of mechanical receiving units are gone forever. Computer technology makes it possible to transmit and receive information at 1200 baud or faster over a normal voice-grade telephone line. A little quick figuring shows this to be much speedier than the amateur 45-baud standard. Even at the more commonly used 300-baud speed, the increase is quite noticeable.

A different set of tones is used for computer communication. Actually, there are

two sets of tones separated by about one kilohertz. One set of tones is used by the originating station, while the other is used by the called station. By piggybacking these signals, two-way simultaneous communication is possible.

It isn't important that you totally understand the theory of data communications to make good use of it. Just keep in mind that both amateur RTTY and telecomputing have the same roots. You'll be a step ahead if you have a basic understanding of the similarities and differences of the two systems.

Who do you talk to once you have your computer ready to communicate with the world? Many areas have local bulletin boards, some even specializing in amateur radio. At the end of a local phone call, a host computer is connected. Most systems allow users to leave messages for each other in electronic mailboxes or to post bulletins to all users. A swap section is often included. One of the bulletin boards (BBS for short) I use even has an ongoing trivia contest!

More advanced systems allow users access to public-domain software. Downloading (as it is called) allows you to receive a program for your own use without having to manually type it in!

The most sophisticated local systems may have multiple phone lines connected to them. Such systems often allow conferencing. It's a bit like a RTTY round table without the interference!

Several national systems merit special mention. Perhaps the most popular and versatile national bulletin board for hams is HAMNET on the CompuServe Information Service Network.

CompuServe is a very large data-base operation operated by H & R Block. The host computer is located in Columbus, Ohio. During business hours, CompuServe is heavily used by commercial users. There is a rather stiff charge for use of the service during these peak usage hours.

After six in the evening local time, the rates drop dramatically, making the service attractive to the hobbyist.

The technology used in connecting to CompuServe makes extensive use of the packet transmission system. This is the same method of message exchange just beginning to be used by amateurs on an experimental basis.

At the other end of your connection to CompuServe is a bank of minicomputers. These machines are much faster and can address a much larger amount of information than your home computer can. Once you have logged onto CompuServe, you have a myriad of information available to you. By typing GO HOM 11, you will be magically taken to HAMNET!

The GO command simply tells the computer to connect you to the Home data base, page 11. That's where HAMNET lives on the system.

During your first visit, you will be offered the chance to join the SIG, or special-interest group. There is no additional charge for joining HAMNET. Standard CompuServe rates apply.

The SYSOP (short for system operator in computer terms) is Scott Loftesness W3VS. You may think of him as net control, though he may not always be on frequency. Scott's jobs are numerous. He maintains the integrity of the information in HAMNET. He must make sure that the system does not exceed its allocated memory space. He has the power to delete inappropriate messages or old files.

The amount of information available in HAMNET is a bit astounding. Among other things, an electronic version of the *W5YI Report* is available for browsing. The latest ARRL information can be found. Programs of interest to HAMNET members are available for downloading.

Just as it is on the air, perhaps the most useful service is the message section where SIG members have ongoing discussions. By using the selective retrieval options available, you can look for messages about your favorite subject. During Owen Garriott's operation, a search for STS resulted in the most up-to-date information I saw anywhere. The same can be done no matter what you are searching for.

HAMNET also has a featured guest each month. Known as the GUEST OP, it's your chance to communicate directly with some of the most well-known people in amateur radio.

Through the use of the conferencing feature, you can even talk to others on the SIG at the same time you are. Depending on how heavily loaded the system is, transmissions are delayed from just a split second to several minutes. It takes some getting used to.

Scott offers a "Hitchhiker's Guide to HAMNET." An SASE with extra postage should get you a copy. Scott's address is: 20324 Highland Hall Drive, Gaithersburg MD 20760.

A little further east is the nation's first national database operation, Source. The prestigious Reader's Digest Association is behind this one. Operation on Source is somewhat different, although the same principles apply.

Source has chosen not to implement SIGs, but rather has one gigantic message board...an electronic version of the bulletin board at your local grocery store. Each message must be assigned a category. Ham radio is one of the available categories.

Once again, the selective-search features make it easy to find the messages you are looking for.

Source also has another area that may prove to be of interest. Called user publishing, interested Source subscribers can electronically "publish" their newsletters, programs, and so on. Source will actually pay you based on how much connect time is spent accessing your work. The whole area is a bit complex, but it could offer the possibility for an on-line DX newsletter, for example.

Rates for Source are slightly higher than CompuServe but are still below $10 per hour during the evening.

There are many other free (except for the phone call) services available for amateur operators. The AMSAT Software Exchange is a good example.

For several years now, Bob Diersing N5AHD has operated a bulletin-board service for OSCAR enthusiasts. Bob comes by his hobby use of computers naturally. He is Director of Computer Services at Corpus Christi State University. To reach the AMSAT bulletin board, dial (512)-852-8194. Normal long-distance rates apply.

I should also mention that from my part of the country, the telephone circuits to Corpus Christi are very poor. This causes some problems in communicating with the system at times.

Your computer can also be used in conjunction with regular amateur equipment to accomplish similar operations on the air. Message-storage operations and program exchanges are becoming very popular.

So whether you are a computer hobbyist new to amateur radio or a ham new to computing, a whole world of information is available to you about your hobby with an inexpensive home computer and a connection to your telephone line. Forget the zoning restrictions and TVI. Telecomputing, or perhaps I should call it telehamming, may be for you! ■

Larry P. Mundinger KC4Q
10017 Westleigh Dr.
Huntsville AL 35803

CoCo's Counter

Use this dirt-cheap method to tune up your AFSK generator.

A number of recent construction articles have described inexpensive RTTY terminal units using the XR-2206 function generator to produce AFSK tones. In each case, a frequency counter is required to adjust the tones for the proper shift. Misalignment of the transmitted tones will prevent stations using very narrow filters from copying your signal and in extreme cases could get you a notice from the FCC.

Since the cost of an inexpensive frequency counter is comparable to that of a simple commercial terminal unit, it is understandable that few newcomers to RTTY are using home-brew equipment. Even if you can borrow a counter from a friend for the initial adjustment, all terminal units, whether commercial or home-brew, should be checked periodically because component values can change with age.

The Radio Shack TRS-80C Color Computer™ is an excellent choice for amateur RTTY use, and with the CoCo counter program it will even help you align your terminal unit. All that is required is a 10k resistor and an extra wire between the terminal unit and the serial I/O connector of the CoCo. These are connected to pin 11 of the XR-2206, as shown in Fig. 1, and can be left in place without affecting operation of either unit.

The program listing is shown. The first part puts the menu on the screen and POKEs the machine-language part of the program into memory. The remainder of the program takes control of two of the 6809 processor's interrupts to perform the counting function. The IRQ interrupt is driven by the field-sync output of the video-display generator and used to time a one-second interval. During this time the FIRQ interrupt, driven by the square-wave output of the XR-2206, is counting cycles. When one second has elapsed, the number of cycles counted is output to the screen by a call to a Basic ROM routine and the keyboard is polled for an input before counting again. The keyboard input allows changing the serial output so that either a mark or a space is generated. EXIT to Basic is the third menu option.

You will not get super accuracy with this method be-

Program listing.

```
100 REM* FREQUENCY COUNTER PRG
110 REM***********************
120 REM*   SET UP SCREEN     *
130 REM***********************
140 CLS
150 PRINT "     FREQUENCY COUNTER
 PROGRAM"
160 PRINT "","",""
170 PRINT "       FREQUENCY IN HE
RTZ"
180 PRINT "","",""
190 PRINT " S TO SET SPACE (2295
 HZ)"
200 PRINT " M TO SET MARK (2125
HZ)"
210 PRINT " E TO EXIT"
215 REM************************
216 REM*   POKE IN MACHINE    *
217 REM*   LANGUAGE PROGRAM   *
218 REM************************
220 FOR A = 5164 TO 5322
221 READ D: POKE A,D
222 NEXT A
223 EXEC 5164
224 DATA 204,20,158,253,1,16,204
,20,175,253,1,13,134,126,183,1,1
5,134,55,183
225 DATA 255,33,134,55,183,255,3
,134,60,183,20,201,127,20,202,12
7,20,203,125,20
226 DATA 201,38,251,134,54,183,2
55,33,204,137,76,253,1,13,204,16
0,246,253,1,16
227 DATA 204,4,140,221,136,134,9
6,183,4,140,183,4,141,183,4,142,
183,4,143,183
228 DATA 4,144,252,20,202,189,18
9,204,173,159,160,0,39,162,129,8
3,16,39,0,42
229 DATA 129,77,16,39,0,43,129,6
9,16,39,139,139,32,142,52,7,252,
20,202,195
230 DATA 0,1,253,20,202,182,255,
32,53,7,59,52,3,122,20,201,182,2
55,2,53
231 DATA 3,59,79,183,255,32,22,2
55,107,134,2,183,255,32,22,255,9
9,0,255
232 END
```

cause the field rate of a color-TV signal is slightly less than 60 Hertz and the CoCo clock is far from a precision frequency standard. My CoCo apparently runs faster than it should because the frequency readouts are about one percent low. What is important is the difference in frequency between the mark and space tones, and this can be set to within two Hertz of nominal. If you can borrow a frequency counter, you can determine the error for your computer and file it for use later when checking for drift. If you can't borrow a counter, then use the values displayed and align the demodulator to respond to your output tones. That way you will be transmitting and receiving on the same frequency. This is important in conserving spectrum space and essential for accessing any of the electronic-mailbox systems on the air.

This program could be incorporated into a general RTTY program as a menu item for use whenever desired. I will be glad to supply an assembly-language listing to anyone who sends me an SASE.■

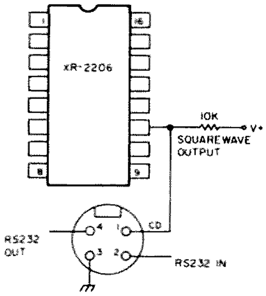


Fig. 1. Wiring diagram.

References

1. "A State-of-the-art Terminal Unit for RTTY," Michael J. DiJulio WB2BWJ, *QST*, December, 1980.
2. "Micro Modem," Albert D. Hearn WA4GKQ, *73*, September, 1982.
3. "Colorful RTTY: An Advanced System for the TRS-80C," Clay Abrams K6AEP, *73*, September 1983.

Neil Harding McAlister VE3KSP
22 Renfield Crescent
Whitby, Ontario
Canada L1P 1B4

Is Ham Radio Baking Us?

What damage occurs when human bodies are subjected to electromagnetic fields is not fully understood. Here, an expert in biostatistics examines the problem from an amateur's perspective—and offers some practical preventative suggestions.

Even if it never happens to you and me—well, hardly ever—we all joke about browbeaten hams whose neglected spouses storm into the shack periodically, demanding that they switch off "that %$#@* radio" on threat of dire consequences.

Wouldn't it be ironic if those impatient wives and husbands have actually been doing these persecuted hams a favor by dragging them away from their beloved rigs? New research into the biological effects of electromagnetic (EM) radiation is beginning to suggest that people who expose themselves to higher-than-normal levels of radio frequencies (rf) and microwaves may no longer be able to take it for granted that these exposures are perfectly harmless.

How significant is the concern? Nobody knows for sure. If there is any danger at all from the emissions of ham-radio equipment, it is neither immediate nor overwhelming: Hams aren't dropping dead by the dozen after a grueling weekend contest. However, our understanding of what rf fields do to people over long periods of exposure (like years or decades) is limited by a shortage of basic scientific knowledge about the effects of EM radiation on human cells, by the virtual absence of population-based (or "epidemiologic") data about large groups of people (like hams) who have been exposed to higher-than-usual levels of rf and microwaves for a long time, and by the vastness of a subject as wide as the electromagnetic spectrum itself.

The electromagnetic frequency spectrum ranges from extremely low frequencies (ELF) or very low frequencies (VLF) of 5 to 300 Hz, with wavelengths in the order of 10^8 meters, up through increasingly higher frequencies and shorter wavelengths. It progresses through radio frequencies from a few kHz to a few MHz, microwaves up to the 100-GHz range, infrared light, visible light, ultraviolet, X-rays, and, finally, gamma rays with frequencies of up to 10^{22} Hz and very short wavelengths in the order of 10^{-14} meters.

Ultraviolet light, X-rays, and gamma rays have quanta of sufficient energy to ionize molecules and break apart their bonds. Such ionizing radiation is known to disrupt many biological functions. Visible light (e.g., a laser beam) does damage by direct heating. Longer wavelengths (microwaves, rf, and ELF) neither have enough energy to cause ionization nor, generally speaking, are they capable of producing damage by heat. Yet it is known that weak electromagnetic fields in these lower frequencies also produce biological effects on living cells. Although these nonthermal effects are incompletely understood, they are applied in orthopedic medicine, where weak, pulsed EM fields are used in the treatment of fractures.

The Effects of Rf and Microwaves

The relatively small amount that we know about the biological effects of EM fields is based on work with test-tube cell preparations and on animal experiments. Very little work has been done to examine comprehensively the health of large numbers of humans who have been exposed to higher-than-average EM emissions.

Writing in a recent issue of the *I.E.E.E. Spectrum*, a magazine received by all members of the Institute of Electrical and Electronics Engineers, Eric Lerner explained that experiments done so far must be interpreted with caution for several reasons. For one thing, in the US most experiments are performed at 27.12, 915, and 2450 MHz—not because there is anything special about these frequencies biologically speaking, but because they are the ones assigned to medical, scientific, and industrial uses. Effects observed at these frequencies are not necessarily produced at different frequencies. He also noted that many experiments are

performed in test tubes, not in living creatures: Test-tube results are not necessarily seen in live animals.

Lerner reports that the most significant experimental finding to date suggests that microwaves can sometimes induce genetic damage in live animals. In one experiment, there was significant harm to sperm cells of male mice exposed to microwaves of 0.915, 2.45, and 9.4 GHz, and a consequent decrease in their fertility. More miscarriages than normal were recorded among their mates, and a notable increase in genetic disorders occurred among the baby mice that did survive. At 27 MHz no such changes were observed.

Microwave-induced genetic damage was also documented in experiments using insect larvae. Whether these observations have any implications whatever for human beings is anyone's guess.

Current Safety Standards

Fundamental lack of knowledge about the biological effects of EM radiation on humans is reflected both in an absence of uniform, enforceable regulations within the United States and by the diversity of standards internationally. The American National Standards Institute (ANSI) has recommended standards for EM emissions from electronic equipment at various wavelengths. However, whether manufacturers adhere to these standards is purely voluntary, and no agency monitors or keeps records of compliance with the ANSI specifications.

The ANSI standards are not the most stringent ones in the world. As seen in Fig. 1, at all frequencies the ANSI-recommended limits for exposure are much less strict than limits set in China and the Soviet Union, for example.

Within the United States, some regional governments are starting to move independently to establish their own safety guidelines. At the time of writing this article, the state of Massachusetts and the city of Portland, Oregon, have proposed standards for the general population that are five times stricter than the ones suggested by ANSI.

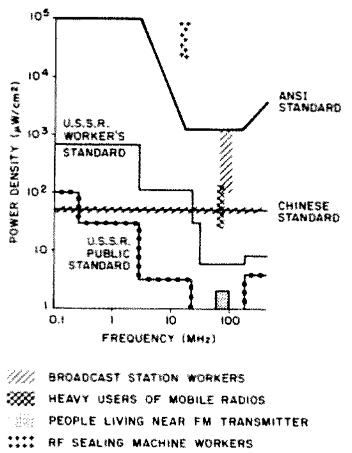


Fig. 1. Limits for exposure to EM fields. Adapted from Lerner, E. J., "The Drive to Regulate Electromagnetic Fields," I.E.E.E. Spectrum, *March, 1984, pp. 63–70.*

The Environmental Protection Agency is now working on a proposed standard for nonionizing EM radiation, but it will be several years, at the earliest, before this becomes federal law applicable to all national government agencies.

While the public and consumers of electronic devices may soon be covered in some American jurisdictions, occupational exposures are generally not included in anyone's recommendations. As shown in Fig. 1, workers who use rf equipment to heat and thereby seal plastic packaging are exposed to levels of rf far exceeding the ANSI recommendations. Many broadcasters work in environments heavily polluted with rf that exceeds the "safe" limits as well.

Of interest to radio amateurs who enjoy mobile operation, frequent operators of mobile transmitters have some of the highest non-occupational exposure to rf fields, coming very near to the recommended "safe" limits.

Practical Suggestions

Should we all rush to put our rigs up for sale on the next swap net and find a safer hobby? Of course not. Life is full of calculated risks. We accept the chance of an accident whenever we cross the street or get behind the wheel of a car. It is highly probable that the EM radiation from ham-radio gear is an insignificant health hazard compared to cigarette smoking—a habit that many amateurs embrace despite its proved and well-publicized dangers. There are many pastimes a lot more dangerous than ham radio: skydiving and scuba diving, for instance.

There are, however, a couple of logical and perfectly acceptable precautions that a radio amateur can take in response to the present state of uncertainty about the biological effects of EM radiation.

We already know many good reasons to avoid unnecessary, habitual QRO operation. For one thing, it is illegal here in VE-land, where regulations require radio amateurs to use the minimum necessary power during a QSO. Running QRO while chewing the rag with someone in the neighboring state clutters up the HF bands with pointless QRM and is therefore discourteous to other amateurs even half a world away.

High power also tends to aggravate TVI problems. Leaving a mobile 2-meter rig stuck on the HI power position when LO would do the job is rude because it is sometimes bothersome to other drivers' cheap car radios; running hot all the time gives the mobile transceiver itself a beating. It is just possible that wasteful QRO is also detrimental to the long-term health of the thoughtless operator, by exposing him or her to unnecessarily high doses of rf.

YL operators will be interested to know that there is no proven association between miscarriages or birth defects and low-level EM radiation, and that many scientists feel there is unlikely to be a connection. On the other hand, neither has absolute safety been proven. Logic suggests that women who are worried enough about extraneous EM radiation to avoid using visual display terminals at work during their pregnancies would probably want to avoid operating or going near ham stations too—at least during the first three months, when the fetus is most susceptible to hazardous, outside influences. Even if future research proves this precaution unnecessary, it would remove a source of anxiety now, when no answers are known with certainty.

The more time a ham spends in the shack, the more rf he or she is exposed to. Since long-term exposure over many years may be the greatest concern, it is probably fortunate that most younger operators have to work or go to school: Young people, who have the greatest number of years of exposure ahead of them, also have less spare time to in-

dulge in their hobby than do their ham friends who are enjoying amateur radio in their retirement. Older hams likely have less to worry about and may derive comfort from the case of the 90-year-old man who has enjoyed booze and cigarettes ever since he was a youth of 16. If he has survived his bad habits this long, there's little reason why he should suddenly quit now!

The Jury is Still Out

The bottom line is that we have no final answers, yet. The long-term effects of above-average, though still relatively low, levels of rf radiation and microwaves on humans are largely unknown, though they are the subject of increasing scientific investigation. To date, no one has proven definitively that a health hazard from low-intensity EM fields actually exists.

On the other hand, there is now some reason to suspect, particularly in view of animal experiments, that there could be at least a theoretical basis for concern. Most important in view of these theoretical worries: No one has yet proven that the above-average exposures incurred by ham-radio operators are harmless—no comprehensive survey of any kind has ever been carried out to compare the health of radio amateurs to the health of nonhams.

In the light of the practical experience of many thousands of radio amateurs over the years, it seems improbable that the dangers of running a ham station are really very great at all. However, in the absence of comprehensive scientific data, assumptions based on common sense, our personal experience, and what seems intuitively obvious can be misleading. In the 1950s, military "experts" told us that above-ground nuclear testing was safe, just because soldiers who witnessed these events weren't dropping dead immediately after a blast. Tragically, we now realize that it has taken two or three decades for some victims of nuclear fallout to manifest the deadly cancers that the original radiation started, years ago.

It would be alarmist and irresponsible to suggest that the emissions from ham-radio transmitters are anywhere near as noxious as nuclear explosions! But even though the scientific jury is still debating its verdict on this issue, we would be well-advised to consider that evaluating a potential health hazard is not like conducting a trial in a courtroom: Where health is concerned, it is bad policy to presume a potentially harmful agent innocent until proven guilty, because we don't get to appeal the sentence of sickness that nature may impose on us if we guess wrong.

Given so much uncertainty about the biological effects of long-term exposure to the frequencies we use in amateur radio, it makes good sense for all us hams to take a few simple precautions that scarcely jeopardize our enjoyment of our hobby. Who knows? It might even clear up some of the QRM on 20 meters! ■

Further Reading

Lerner, E. J., "The Drive to Regulate Electromagnetic Fields," *I.E.E.E. Spectrum*, March, 1984, pp. 63-70.

Lerner, E. J., "Biological Effects of Electromagnetic Fields," *I.E.E.E. Spectrum*, May, 1984, pp. 57-69.

Editor's Note: VE3KSP is a medical doctor, Assistant Professor of Preventive Medicine and Biostatistics at the University of Toronto, and a partner in Clinicom Computing Services International, Inc., of Winnipeg, Manitoba, and Toronto, Ontario, Canada.

Robert Roehrig K9EUI
314 S. Harrison Street
Batavia IL 60510

AFSK, And Ye Shall Transceive

A sine from heaven is what you'll get when you build the AFSK-1020.

This article describes a crystal-controlled, synthesized AFSK oscillator for generating RTTY tones. There have been other articles on AFSK oscillators, but the crystal-controlled ones usually use an odd crystal that must be special ordered. The AFSK-1020 (170 plus 850 shift) is designed to use a standard source frequency of 1, 2, 4, or 8 MHz that can be derived from an on-board oscillator or taken from your microprocessor, frequency counter, or whatever other standard frequency source you may have in the shack. By selecting the type of divider IC used, you can also clock the unit from a 5-, 6-, 10-, or 12-MHz source.

The slight disadvantage with using a 1-MHz reference frequency rather than 1606.5 kHz is that the tones will not be exactly right on frequency, but they will be within 3 Hz, which is accurate enough for any application.

The AFSK-1020 will accept current-loop, TTL, or RS-232 inputs for the data signal. A down-shifted CW-ID input is provided and can be operated by either a contact closure (key) or a TTL device.

The output signal is a clean sine wave. This is obtained by running the square-wave output of the last divider through a pi-network filter. The tone levels are within 1 dB of each other. The output impedance is capable of feeding either high-impedance or 500-Ohm inputs. If a transmitter with a carbon-mike-type input is to be used, the output coupling capacitor should be increased to 10 uF, observing proper polarity. You can eliminate the 88-mH inductor and .04-uF capacitor for use with FM rigs where a clean sine wave is not of utmost importance. The remaining components will round off the square wave and reduce the harmonic content, but the filter as shown should be used if you are going to use this with an SSB rig. On FM it is best to reduce the oscillator level so that the signal is not clipped in the transmitter's audio system. A peak deviation of 3 kHz is ideal. In most cases an output level of about 25 mV rms is a good starting point.

The 1-MHz reference signal feeds a string of three programmable dividers: IC3, IC4, and IC5. The output of the last programmable divider, IC5, connects to the load input of all the dividers. This same output also connects to a D-type flip-flop, IC6. The purpose of this divide-by-two stage is to convert the narrow load pulse

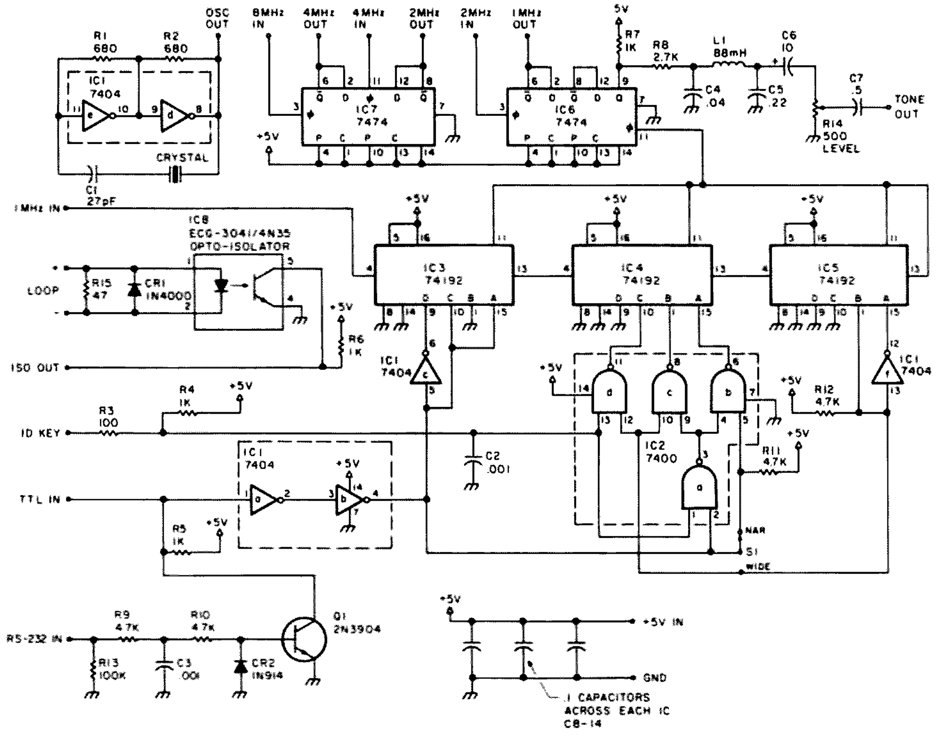


Fig. 1. AFSK-1020 oscillator.

Freq. (Hz)	IC5	IC4	IC3
	Divide by		
1070.6	4	6	7
1269.0	3	9	4
2024.2	2	4	7
2222.2	2	2	5

Fig. 2. Divide figures for modem tones.

to a symmetrical square wave.

The binary inputs of the dividers are taken high by sections of IC1 and IC2 to obtain the desired divide ratios.

If you use a 1-MHz source, connect it to the input of IC3. A 2-MHz source would be connected to the other half of IC6, and the output of IC6 would connect to IC3. IC7 is another dual flip-flop which is used if the frequency source is 4 or 8 MHz. If you want to use 5 or 10 MHz, use a 7490 ahead of IC3. For 12 or 6 MHz, substitute a 7492. (The one half of IC6 is always used to divide the output by 2.)

IC1D and E are used as a simple but reliable oscillator circuit which will work with crystals in the 1-to-20-MHz range. If you want to use the built-in oscillator and have to purchase a crystal, specify a fundamental, parallel-mode, 32-pF-load, room-temperature crystal. You will find that 4- or 8-MHz crystals are usually $1.50 cheaper than a 1- or 2-MHz one. The additional 7474 IC needed costs less than that.

IC8 is representative of several optoisolators. It would be used for connecting the AFSK-1020 to a current loop and may be eliminated if you don't need it. The ISO OUT terminal would be connected to the RS-232 input if IC8 is used. The 1N4000 diode protects IC8 from spikes and inadvertent polarity reversals in the loop.

The RTTY rules have been changed recently so that CW ID is no longer needed for Baudot or ASCII transmissions. If you send long

Parts List

1	27 pF	C1
2	.001 uF	C2, 3
1	.04 uF	C4
1	.22 uF	C5
1	10 uF, 25 V	C6
1	.5 uF	C7
7	.1 uF	C8-14
1	1N4000	CR1
1	1N914	CR2
1	7400	IC2
1	7404	IC1
3	74192	IC3-5
2	7474	IC6, 7
1	4N35	IC8*
1	47 Ohms, 1 W	R15
2	680 Ohms	R1, 2
1	100 Ohms	R3
4	1k	R4-7
1	2.7k	R8
4	4.7k	R9-12
1	100k	R13
1	500-Ohm pot	R14
1	88 mH	L1
1	2N3904	Q1
1	SPDT switch	S1

Crystal: 4 or 8 MHz, room temperature, parallel mode, 32-pF load, HC-33 or HC-18 holder (microprocessor line crystals), available from Jan Crystals for about $3.00.

* or equivalent: ECG-3041.

text or pictures, the ID is still handy so that the copy won't have printed callsigns in it. The best ID is one that shifts lower than the mark frequency rather than up towards space, as many do. This prevents the receiving machine from seeing the "key down" tone as a space. In this unit, the ID tone frequency is 2040.8 Hz.

As mentioned earlier, the derived tones are slightly off from the standard tone frequencies, but they are so close it does not matter. Mark is 2127.6 Hz, narrow-shift space is 2293.5 Hz, and wide-shift space is 2976.1 Hz.

This circuit can also be used to construct the modulator portion of a data modem. Fig. 2 shows the divide-by-n figures needed to obtain the originate- and answer-tone pairs used for 103 compatible systems. I leave it to you to figure out the connections to the divider's programming leads.■

Through the Looking Glass

If you could peek at a RTTY signal through magic audio glasses, what would you see? You'll find out with KN4L's Apple opus, a program that whispers, "Run me."

Scott D. Schram KN4L
225 La Prado Place
Homewood AL 35209

As I was trying to learn more about RTTY, I felt that "book knowledge" of the subject wasn't going to be enough. I wanted to actually see the marks and spaces that were being sent. That's why I wrote this program.

This program for the Apple II or Apple IIe requires input from a RTTY terminal unit (TU). The TU should output TTL-compatible voltages: high (5 volts) for mark and low (0 volts) for space. Attach the TTL output of the TU to pin 2 (Switch 0 input) of the Apple game connector. This is the same connection used for several popular RTTY programs for the Apple.

Sample outputs from the program are shown in Figs. 1

```
                   ********************************
                   *                              *
                   *    RTTY WAVE FORM DISPLAY    *
                   *              BY              *
                   *        SCOTT D. SCHRAM       *
                   *                              *
                   ********************************
                   *
                            ORG   $300
                   *
                   *    *** EQUATES ***
                   *
                   SPEAKER   =    $C030
                   RTTYIN    =    $C061
                   WAIT      =    $FCA8
                   *
                   BUFSTART  =    $4000
                   BUFEND    =    $4FFF
                   *
                   INDEXL    =    $06
                   INDEXH    =    INDEXL+1
                   *
                   *    *** THE MACHINE LANGUAGE PROGRAM ***
                   *
                   * INITIALIZE INDEX TO BEGINNING OF BUFFER
                   *
0300: A9 00         RTTYWAVE LDA  #<BUFSTART
0302: 85 06                  STA  INDEXL
0304: A9 40                  LDA  #>BUFSTART
0306: 85 07                  STA  INDEXH
                   *
                   *    *** LOOP, COLLECTING DATA EVERY 1/500 SEC.
                   *
0308: A0 00         LOOP     LDY  #0
030A: AD 61 C0               LDA  RTTYIN       ;GET MARK/SPACE DATA
030D: 91 06                  STA  (INDEXL),Y   ;SAVE IT IN THE CURRENT LOCATION.
                   *
030F: A9 19                  LDA  #25          ;DELAY FOR 1/500 SEC USING APPLE
0311: 20 A8 FC               JSR  WAIT         ;MONITOR ROUTINE
                   *
0314: EE 00 04               INC  $400         ;FLASH INDICATOR
                   *
0317: E6 06                  INC  INDEXL       ;MOVE INDEX UP ONE BYTE
0319: D0 05                  BNE  RW1
031B: E6 07                  INC  INDEXH
031D: 2C 30 C0               BIT  SPEAKER      ;CLICK SPEAKER
                   *
0320: A5 07         RW1      LDA  INDEXH       ;TEST FOR END OF DATA
0322: C9 4F                  CMP  #>BUFEND     ;BUFFER.
0324: D0 E2                  BNE  LOOP         ;IF NOT THE END, LOOP.
0326: A5 06                  LDA  INDEXL
0328: C9 FF                  CMP  #<BUFEND
032A: D0 DC                  BNE  LOOP
032C: 60                     RTS
                   *
                   ********************************
```

Listing 1. RTTYWAVE source code.

```
1   REM  RTTY WAVE FORM DISPLAY
2   REM  BY SCOTT D. SCHRAM (KN4L)
3   REM
10  HIMEM: 8192: REM  PROTECT HIRES SCREEN AND RTTY DATA
15  REM
16  REM  BSAVE THE MACHINE LANGUAGE PROGRAM AT $300
17  REM  USING THIS NAME
18  REM
20  PRINT  CHR$ (4);"BLOAD RTTYWAVE.OBJ"
21  REM
23  REM  TITLE PAGE
25  REM
30  TEXT : HOME
40  VTAB 5: PRINT  TAB( 9);"RTTY WAVE FORM DISPLAY"
50  VTAB 7: PRINT  TAB( 19);"BY"
60  VTAB 9: PRINT  TAB( 10);"SCOTT D. SCHRAM KN4L"
70  VTAB 22
80  INPUT "PRESS RETURN TO BEGIN READING : ";A$
82  REM
84  REM  THE MACHINE LANGUAGE PROGRAM DOES ALL OF THE
86  REM   READING OF DATA.
88  REM
90  CALL 768
95  REM
96  REM  DISPLAY 2 SCREENS FULL OF RTTY WAVE FORMS.
98  REM
100  FOR LOC = 16384 TO 18432 STEP 2048
110  HGR : HCOLOR= 3
111  HOME : VTAB 21
112  PRINT "EACH DIVISION IS APPROX. 20 MILLI-SEC."
114  PRINT "MARK HIGH, SPACE LOW."
116  REM
117  REM  PRINT THE 20 MILLISECOND DIVIDING MARKS
118  REM
120  FOR X = 0 TO 270 STEP 10
125  FOR Y = 0 TO 140 STEP 20
130  HPLOT X,Y TO X,Y + 1
131  NEXT Y
132  NEXT X
133  REM
134  REM  MOVE DOWN THE SCREEN AND SHOW 8 LINES
135  REM
137  FOR DOWN = 0 TO 7
138 BASELOC = LOC + DOWN * 256: REM  LEFT HAND SIDE OF EACH LINE
140  FOR X = 0 TO 279
142  REM
144  REM  ASSUME THE NEXT PLOT IS A MARK
145  REM  UNLESS THE DATA IS LESS THAN 128.
146  REM
150 Y = DOWN * 20 + 9
160  IF  PEEK (BASELOC + X) < 128 THEN Y = DOWN * 20 + 13
162  REM
164  REM  PLOT THE MARK OR SPACE
166  REM
167  IF BASELOC + X > 20479 THEN 180: REM  END OF BUFFER
170  HPLOT X,Y
180  NEXT X: REM  NEXT DOT ACROSS
185  NEXT DOWN: REM  NEXT LINE DOWN THE SCREEN
186  REM
187  REM  WAIT FOR USER TO PRESS RETURN BEFORE
188  REM  GOING TO NEXT SCREEN OR ENDING THE PROGRAM.
189  REM
190  HOME : VTAB 22
200  INPUT "PRESS RETURN TO CONTINUE : ";A$
230  NEXT LOC
232  REM
234  REM  SEE IF USER WANTS ANOTHER PLOT
236  REM
240  TEXT : HOME
250  INPUT "AGAIN? (Y/N) : ";A$
260  IF  LEN (A$) = 0 THEN  END
270  IF  LEFT$ (A$,1) = "Y" THEN 30
280  END
```

Listing 2. Basic display program.

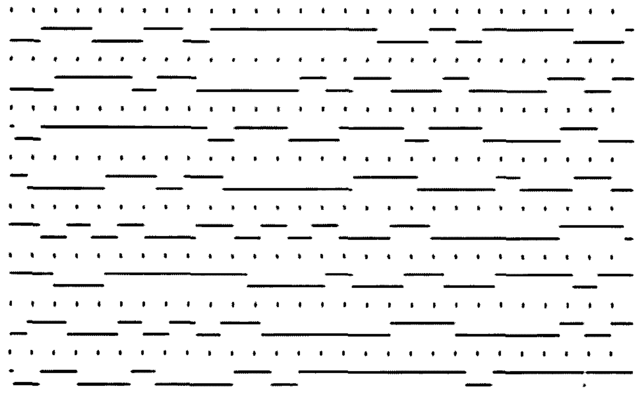


Fig. 1. Output for a 60-wpm received signal.

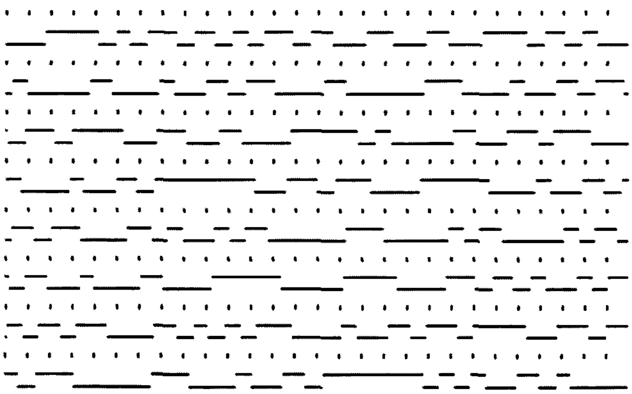


Fig. 2. Output for a 100-wpm received signal.

and 2. There are eight lines of mark/space shown, with short hash marks above each line. Note that each line repeats a little of the previous line's data to allow easier analysis. (If you don't like this feature, change line 140 to FOR X=Ø TO 255.) The hash marks are about 20 microseconds apart. The entire 8 lines represent 4 seconds of received signal.

This program presents interesting analysis possibilities. Fig. 1 is the output from a 60-wpm-Baudot received signal. The shortest mark and space lines are the data bits which are about 22 ms long. This is about what we would expect for a 60-wpm signal. Notice the glitch in the lower right-hand corner of Fig. 1. This error was caused by a static crash distorting a weak signal. You see, it is much too short in duration to be a data pulse. This might have caused an error in printout.

The 100-wpm-Baudot signal was from a very strong station, and I see no glitches in the copy. Note that the shortest data bit is about 14 ms, which is about right. This suggests that a good use for the program would be determining the speed (and code type) of an unknown RTTY broadcast.

Type in the Applesoft Basic program and save it to disk. The machine-language portion should be typed into a good assembler and assembled. (I use Merlin from Southwestern Data Systems or the assembler that comes on Apple's DOS Toolkit package. There are many other excellent ones available.) After assembly, BSAVE the code to disk under the name RTTYWAVE.OBJ. The Applesoft program loads it in automatically. If you don't have an assembler, type in the bytes from my listing and BSAVE it (BSAVE RTTYWAVE.OBJ,A$3ØØ,L$2D).

To start the program, just run the Basic program. The Basic program loads the machine-language part. You will then be presented with the title page and the prompt, "PRESS RETURN TO BEGIN READING:". Tune in the RTTY signal until your terminal unit shows proper reception, then press return.

Data will be read in for about eight seconds. A little indicator will flash in the upper-left corner of the screen to keep you from dozing off. Also, the Apple's speaker will click once per second.

Then the program will display the first screen of the waveform. Press return to see the second screen. The display portion is a little slow, but this can be improved by compiling the Basic part using any of the commercially-available Applesoft compilers. If you compile it, please observe the memory usage shown in Fig. 3.

After viewing both screens, you may read in more data or exit the program.

I hope this program benefits you. It should be a challenge to figure out the codes that some stations are using. (It is quite a challenge just to read the normal Baudot code by eye!) Perhaps you could extend this program to determine automatically the speed and code used by an unknown RTTY station. That should keep you busy.

I welcome your comments. If you wish a reply, please include an SASE.■

Address	Purpose
$0006 TO $0007	Buffer index
$0300 TO $032C	Machine code
$2000 TO $3FFF	High-resolution screen
$4000 TO $4FFF	RTTY data buffer

All other addresses are as the Apple normally uses them.

Fig. 3. Memory-usage table.

Perfection Plus

It's not often a prize-winning package can be improved. Here's a new look for a popular RTTY tuner.

Jack Miller W1PDI
51 Skyview Circle
Hamden CT 06514

In the March, 1983, issue of *73*, John Langner WB2OSZ offered an article and description of his RTTY tuner which won 1st place in *73's* Home-Brew II Contest. It's not at all surprising that this unit won, as it is an excellent RTTY tuning device and makes tuning in a RTTY signal as easy as tuning an FM receiver with a tuning meter, as stated in the article.

I decided to give it a try. The idea of having an LED display seemed better than fussing with a dual ellipse on a scope or trying to tune a signal with the blinking LED on my TU. This LED seems to blink on almost any kind of signal within the bandpass, and trial and error becomes necessary before you tune in the right blink.

In his design, John used two Radio Shack MV57164 bar-graph displays for 20 audio frequencies (1530 Hz through 3003 Hz). Each bar graph has 10 miniature LED segments. The mark and space frequencies between 2113 Hz and 2309 Hz are in the center of the display. This miniature bar-graph arrangement would be ideal if you wanted to build it into the front panel of your TU. I decided to avoid cutting into my MVD-1000, as homemade modifications to commercial gear have a definite tendency to reduce its resale value. Building the unit in a separate enclosure with power supplies and separate LEDs seemed a better idea to me.

I used a plastic enclosure manufactured by Pac Tec

Photos by Tom Miller WA1GLS and Jeff Miller

Photo A. Completed unit on top of monitor in my shack.

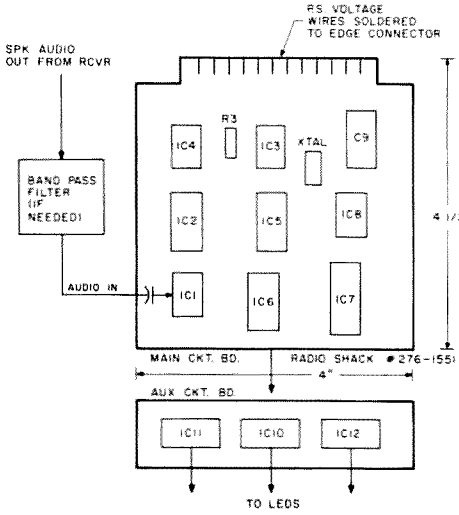


Fig. 1. Main and auxiliary circuit boards showing IC arrangement.

Corporation,[1] Model C-23K. These enclosures are available in a variety of dimensions and colors, even with a carrying handle and stand if you choose. Many manufacturers of digital test equipment use this type of enclosure as it offers great flexibility and neat appearance. The dimensions of the Model C-23K are approximately 8½" wide by 9½" deep, with expandable front and rear panel heights. The front and rear panels have three indentations along their length on the back side for trimming. Score with a sharp knife blade along the indentation you select, and then snap it off. I trimmed the front panel 2-5/8" high, and the rear panel 2-1/8".

There are plenty of mounting studs on the inside for mounting almost any shape perfboard or component needed. Those studs that are not needed or are in the way of mounting can be snapped off easily with a pair of pliers.

Since I had ample panel space, I decided not to use the Radio Shack bar-graph units. Instead, I used twenty separate LEDs manufactured by Linrose Company.[2] These LEDs are rated at 5 volts and have a built-in loading resistor, so that the 82-Ohm R-10 in the original tuner is not used. The packaged LEDs also have the little fiber mounting flange which holds the LEDs when they are snapped into a 1/4" mounting hole. This separate LED arrangement makes the complete display larger and easier to see than the bar-graph arrangements.

As shown in Fig. 4, the LEDs are mounted in 1/4" holes in a straight line across the front panel on 3/8" centers. The eight LEDs in the middle between the mark and space frequencies are red, and the six on each side are amber. The LED in the upper right corner is a green pilot. The on/off switch is mounted in the lower left corner.

The ac cord and fuse holder and a parallel phono-type input-plug assembly for the receiver output and TU input are on the rear panel. The rear panel height is cut approximately ½" shorter than the front panel to allow for ventilation.

Main Circuit Board

I used the same circuit board and IC arrangement as the author. The circuit board is a Radio Shack catalog #276-1551. It is a 4½" × 4" polyglass plug-in-type card with 1/16" grids. I did not use an edge socket, but soldered the power-supply wires directly to the edge connector.

There are also 2 bus runs around the edges, which make it convenient for supplying the plus and minus 5 volts to the ICs without running long wires to a single input point. The best feature is its cost, $3.69, which is far lower than the price I have seen for other boards of this type.

I mounted nine ICs and other components on this board. The three decoder-driver ICs are mounted on a smaller auxiliary board (Fig. 5(b)). The IC socket locations are shown in Fig. 1. If desired, you can mount all of the ICs and components on a single larger board, as there is ample room inside the enclosure to do so.

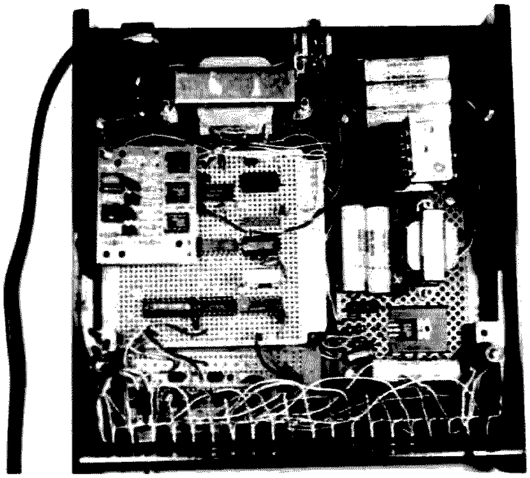


Photo B. Shows inside layout of components. Main circuit board on left with Flesher PS-170 bandpass filter mounted above it. Power-supply assembly is on the right with T2 in the center. The 12-volt regulator transistor is on the heat sink below. T1 is at the rear next to the fuse holder. LED arrangement is shown in front with leads running to the driver perfboard assembly mounted in front of the main circuit board.

Wiring

Use point-to-point wiring with single-strand insulated wire. I used the same gauge wire as Ma Bell uses in her multi-conductor phone cable.

This schematic, as shown in the original article, is correct. If you follow it exactly, the unit should work the first time. When wiring, I kept the wire lengths as short as possible without letting the wire pile up too much over the sockets. When necessary, a graceful loop around the socket is better than going directly across and piling up. Be sure to determine the location of the mounting holes in the component board first. Keep your wiring clear of the holes so it won't be pinched or broken when mounting the board to the enclosure mounting studs.

A note of advice: It's a good idea to stop and check your wiring after making four or five connections. You'll be surprised when what you thought was a correct connection actually is not. While this wiring project is not very difficult for the experienced builder, it can be tiring on the eyes, and mistakes are made easi-

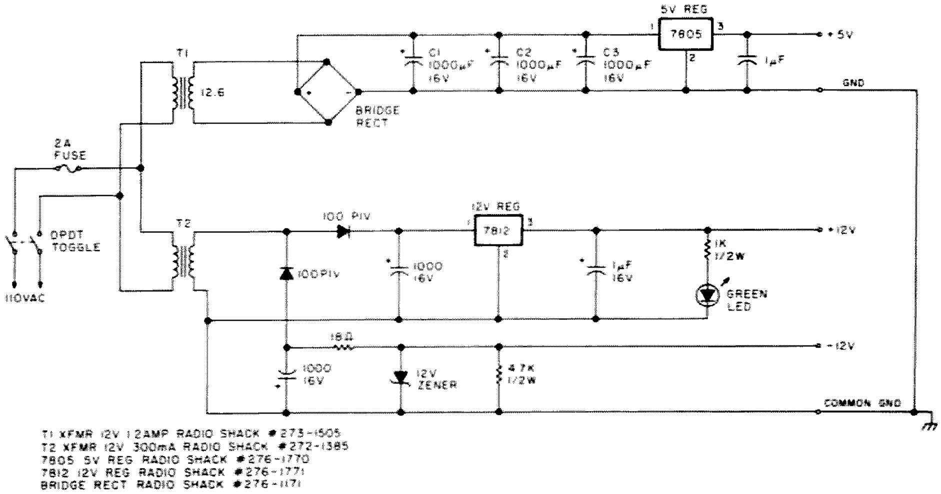


Fig. 2. Power supplies.

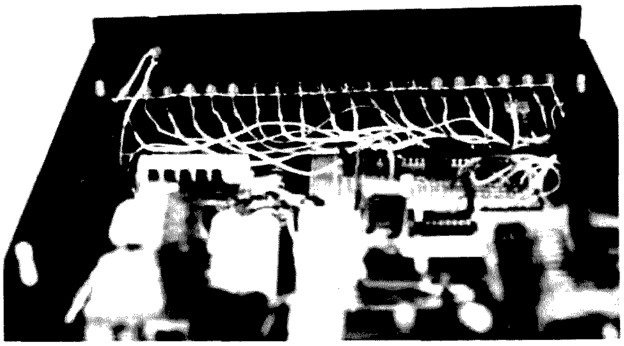


Photo C. Rear view of front panel showing LED arrangement on front panel.

Photo D. The improved RTTY tuning aid.

ly when you are tired. Stop and check your connections frequently and when you're tired, stop—period. Then pick it up tomorrow.

Power Supplies

To power the unit, I needed regulated voltages of +5, +12, and −12. Fig. 2 shows the 5- and 12-volt power supplies. The 5-volt supply is from the *Archer Engineers Notebook*, 1980 edition. Parts are readily available. If there is a Radio Shack store in your area, they're all available there. As shown in Photo B, all power-supply components except T1 are mounted on a separate perfboard. T1 is bolted directly to the bottom of the plastic enclosure near the rear panel, next to the fuse holder. Both regulator transistors should have heat sinks. The 5-volt regulator dissipates more heat than I anticipated, so I had to add on a fancy heat-sink arrangement using quarter-inch aluminum brackets fastened together over and under the regulator.

You might prefer to build the 5-volt regulator assembly on a 1/4"-thick piece of aluminum with the 7805 regulator bolted to it for better heat dissipation. In either case, be sure to drill several small holes through the bottom of the enclosure directly beneath the regulator assembly for air-flow ventilation.

Bandpass Filter

WB2OSZ, in his article, discusses the use of a bandpass filter in conjunction with this unit. Indeed, if you are driving the tuner directly from the voice coil of your receiver, which has no audio filtering for RTTY, then a filter is desirable. I use a Kenwood TS-520SE transceiver which has no filtering of any kind for RTTY. The tuner works very well connected without a filter, but all the noise and QRM show up by the amber LEDs being lit up as well as the red ones. Ideally, only the red LEDs should light when tuning in a strong RTTY signal.

I purchased the Flesher Corporation[3] P-170 Preselector Kit. This kit, which can be powered by plus or minus 12 volts, contains a small perfboard, three ICs, and a variety of resistors and capacitors. Assembly is easy. The manufacturer supplies several "tuning" resistors, which are temporarily tack-soldered across each of four circuits until the proper resistor is found for each output at frequencies of 2420, 2000, 2320, and 2100 Hz.

Instead of using this hunt-and-peck method, I soldered in four 10k trimpots, adjusted each for peak output as instructed, and left them in the circuit. Works great! I also used IC sockets rather than soldering the ICs directly to the board.

The manufacturer's specs state a frequency response of ±½ dB from 2055 to 2365 Hz, −3 dB cutoff from 2025 to 2400 Hz, and −20 dB cutoff from 1900 to 2550 Hz.

This filter made a great difference in the display. A strong RTTY signal lit up only the red LEDs between the space and mark frequencies (2125 and 2295 Hz).

IC Layout

Figs. 5(a) and 5(b) show a top view of the IC sockets with voltage readings for troubleshooting. Do not take these voltage readings as "gospel," as I took them at random, jotting them down as I made various tests and transferring them from scribblings to some form of logic (I think).

A couple of the ICs were

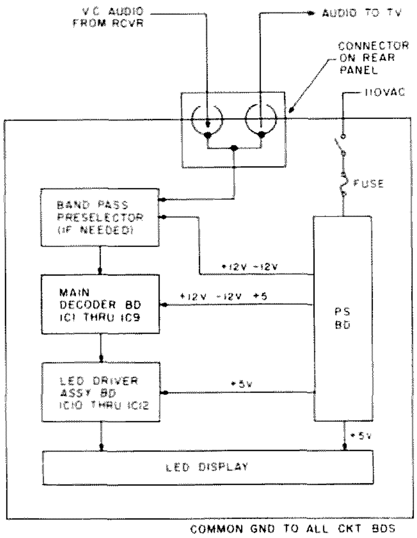


Fig. 3. Block diagram.

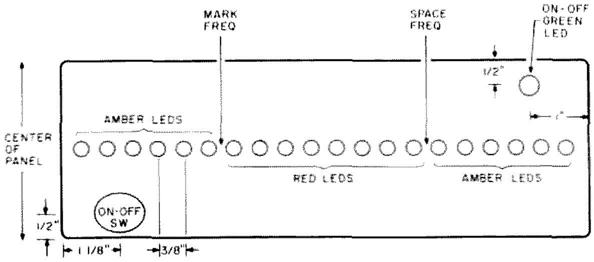


Fig. 4. Front-panel layout.

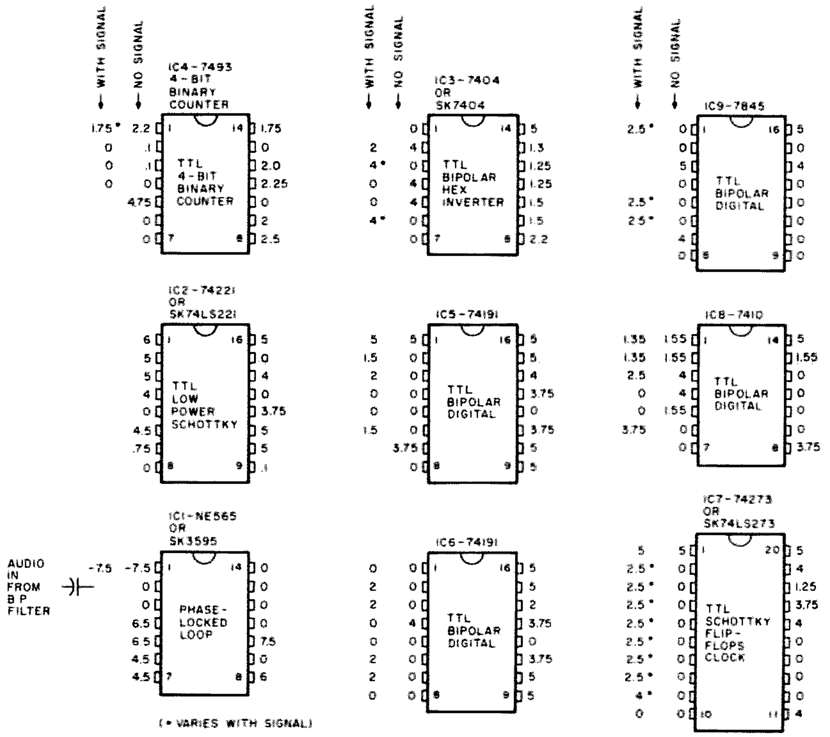


Fig. 5(a). Dc voltage readings.

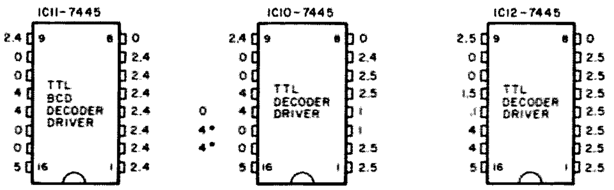


Fig. 5(b). Decoder-driver ICs on auxiliary board.

not readily available from local suppliers or in the usual catalogs. IC2 (74221) and IC7 (74273) are not listed. You can substitute RCA SK74LS221 and SK74LS273, which are readily available at a slightly higher price.

Also, SK3595 can be substituted for the NE565 (IC1). These are Schottky ICs which, according to the specs I've seen, are a more sensitive device drawing significantly less current, and so, perhaps, are worth the extra cost.

Be sure to use plenty of .01 bypass caps to ground. Bypass all power-supply voltage leads where they leave and enter each circuit board; also on the IC sockets at the +5-volt pins. These reduce the spikes which occur when the LEDs are turned on and off.

Parts List

DPDT toggle switch	
2-A 3AG fuse and holder	
T1 transformer, 12 V, 1.2 A	(Radio Shack 273-1505)
T2 transformer, 12 V, 300 mA	(Radio Shack 272-1358)
Bridge rectifier, 12 V	(Radio Shack 276-1171)
1000-uF, 16-V caps (five)	
7805 5-V regulator	(Radio Shack 276-1770)
7812 12-V regulator	(Radio Shack 276-1771)
.1-uF, 12-V capacitor	
1-uF, 16-V capacitor	
100 piv diodes (two)	
12-V zener diode	
1k resistor, ½ W	
12-V green LED	
18-Ohm resistor, 1 W	
4.7k resistor, ½ W	

Use and Conclusion

After completing everything except installing the bypass filter, I connected the unit to the output of my receiver audio and the input of the TU, plugged in the ac cord, and turned it on. The first thing I noticed was that there was no smoke: Good beginning! There was no LED display either until I adjusted R3 on the main circuit board. Then I saw some action on the LED display (random flashes). As I tuned the receiver through various signals and noise, the display indicated what I tuned in by random flashes across the entire panel. Then, as I tuned in a RTTY signal, the LEDs lit up like the traveling light display on an old movie theatre marquee, starting with the first amber LEDs, "walking" through the red, and out the other side of the amber set.

Retuning the receiver so that only the red LEDs were flashing produced a perfect copy on my TU. Works every time! You can tune in a signal as quick as a flash (pardon the pun).

Since my Kenwood has no filtering, and unless the RTTY signal is a strong one, the amber LEDs flash as well as the red, indicating QRM and noise displayed. Installing the bandpass filter, as suggested by WB2OSZ, takes care of this condition very nicely. The filter not only reduces the noise display, but makes the unit much more sensitive and the red display more positive.

The only problem I had was with an odd audio frequency oscillation which was produced when connecting the bandpass filter. But bypassing to ground the 12-volt power-supply leads with .01-microfarad caps on the filter board (directly where they enter) solved this problem nicely.

Even tuning in a weak RTTY signal surrounded by QRM is easy. Just tune between the mark and space and the TU response.

Try it, you'll like it! Tuning in a RTTY signal is now a pleasure instead of a task. It works every time and eliminates a good deal of missed copy. ■

References

1. Pac Tec Corporation, Philadelphia PA 19153. Available from Hatry Electronics, 610 Boulevard, New Haven CT 06517.
2. Linrose Company (B4302H3—Amber, B4304H1—Red). Available from Hatry Electronics.
3. Flesher Corporation, PO Box 976, Topeka KS 66601. Manufacturer states that PS-170 kit is currently limited to available stock at $15.95; PS-170A is the current version at $29.95.

Rick Bates WA6NHC
345 S. McDowell Blvd.
Suite 219
Petaluma CA 94952

Speak-No-Evil RTTY

This tiny routine is all you need to transform your Heath H-8 into a RTTY receiving demon!

If you ever wanted a short, receive-only (RO) RTTY program for your home computer or you just wanted to see what RTTY was all about, then this is for you.

By using Microsoft™ Basic (the most common Basic in home computers today) and a terminal unit (TU), copying RTTY is really very simple. I have a Heath H-8™ computer and the H-19™ terminal. My TU is a home-built, phase-locked-loop (PLL) type which is adequate for VHF (2-meters) RTTY. I have used this equipment on RTTY for about 5 years with various programs including this one. The serial card for the H-8 (and the H-89™) uses an 8250 asynchronous communication element (ACE) chip to handle the serial I/O. The 8250 is very simple to program and has a wide variety of abilities.

The program listing is fairly well documented so that other computer owners may adapt the main ideas to their systems. It may be rewritten so that the input is sent to both the display and the disk, but the slow speed of the operating system causes loss of characters each time it writes to the disk. If the program were interrupt-driven, then perfect copy to disk would be possible. The 8250 ACE chip is capable of interrupt operations, but I just wanted a short and simple copy program.

The most common baud rate for amateur use of Baudot (Murray) code is 45.45 (60 wpm). The first step in the program is to initialize the port (330 octal in this case) for that baud rate and then set up an array for the proper translation from binary to ASCII for the display.

The next step is to get the character from the port and to filter the garbage so that only the valid characters are printed. This is actually done by one of the features of the ACE chip. If the bits from the Line Status Register (of the ACE chip) are checked before the actual input of the character, then it is easy to filter out the garbage. In this case, we are really looking at bits 0 through 5 of the Line Status Register which show that the data has been received without any errors.

If there has been an error in receiving the data, you loop back and ignore the character in the port, which will be overwritten by incoming data. You must look at the Data Ready bit (bit 0) of the Line Status Register each time you are ready to input from the port or you will get duplicates of the last character received since the character buffer in the ACE chip is not emptied when it is read (but the Data Ready bit is zeroed). You could also use the Carrier Detect line of the ACE chip to filter out some garbage. I have my TU hardwired so that it will not send data to the port unless it sees the Carrier Detect bit set on the PLL chip.

The next part of the program checks for the FIGS or LTRS shift character. If one is found, the case label value will be changed so that the character is printed in its proper case (letters or

```
10 '    Copy RTTY ASCII to CRT program
20 '    By Rick Bates WA6NHC version 2.2A rpb
100 '   inialize the port (330 octal) for input
110 OUT 219,128 'turn DLAB on to program the chip
120 OUT 216,23  'LSB for 110 baud
130 OUT 217,4   'MSB for 110 baud
140 OUT 219,7   '2 stop bits DLAB off
150 IF INP(221)>96 THEN 160 ELSE 150     'filter the garbage
160 PRINT CHR$(INP(216));;        'print it, if good
170 GOTO 150    'go back for next character
```

Table 1.

BINARY	LETTERS	OCTAL	FIGURES	DECIMAL	HEX
00000	NULL	000	NULL	0	00
00001	E	001	3	1	01
00010	LINE FEED	002	LINE FEED	2	02
00011	A	003	-	3	03
00100	SPACE	004	SPACE	4	04
00101	S	005	BELL	5	05
00110	I	006	8	6	06
00111	U	007	7	7	07
01000	(CR)	010	(CR)	8	08
01001	D	011	$	9	09
01010	R	012	4	10	0A
01011	J	013	'	11	0B
01100	N	014	,	12	0C
01101	F	015	!	13	0D
01110	C	016	:	14	0E
01111	K	017	(	15	0F
10000	T	020	5	16	10
10001	Z	021	"	17	11
10010	L	022	)	18	12
10011	W	023	2	19	13
10100	H	024	# (POUND)	20	14
10101	Y	025	6	21	15
10110	P	026	0 (ZERO)	22	16
10111	Q	027	1	23	17
11000	O (OH)	030	9	24	18
11001	B	031	?	25	19
11010	G	032	& (AND)	26	1A
11011	FIGURE	033	FIGURE	27	1B
11100	M	034	.	28	1C
11101	X	035	/	29	1D
11110	V	036	;	30	1E
11111	LETTERS	037	LETTERS	31	1F

Table 2.

```
10 PRINT CHR$(27)"E"      'clear the screen
20 PRINT "RTTY (Baudot) to CRT copying program"
30 PRINT "By Rick Bates WA6NHC version 2.3B rpb"
40 PRINT: PRINT
100 '
110 '    set up port (330) octal for baudot input and data tables
120 '
130 PORT=&O330
140 OUT PORT+3,128        'set DLAB on for programming
150 OUT PORT, &O346:      'lsb for 45.45 baud
160 OUT PORT+1,&O11:      'msb for 45.45 baud
170 OUT PORT+3,4          'set for 5 bit word, 1.5 stop bits DLAB off
180 '
200 DIM L(32),U(32)       'input characters (lower and upper), 32 possible
210 FOR X=0 TO 31: READ L(X): NEXT X     'set lower case (LTRS)
220 FOR X=0 TO 31: READ U(X): NEXT X     'set upper case (FIGS)
230 CASE=0        'pre-set for lower case
300 '
310 '    input character from the baudot port
320 '
330 IF INP(PORT+5).96 THEN 340 ELSE GOTO 330     'filter garbage
340 INCHAR=INP(&O330)     'get the character when the port is ready
400 '
410 '    set for proper case
420 '
430 IF INCHAR=27 THEN CASE=1:GOTO 300    'upper (FIGS)
440 IF INCHAR=31 THEN CASE=0 :GOTO 300   'lower (LTRS)
450 IF INCHAR=4 THEN CASE=0      'downshift on space
500 '
510 ' print it in the proper case
520 '
530 IF CASE=1 THEN PRINT CHR$(U(INCHAR));        'print in the proper case
540 IF CASE=0 THEN PRINT CHR$(L(INCHAR));
550 GOTO 300
1000 '
1010 '    data for lower case characters
1020 '
1030 DATA 0,69,10,65,32,83,73,85,13,68,82,74,78,70,67,75
1040 DATA 84,90,76,87,72,89,80,81,79,66,71,0,77,88,86,0
1050 '
1060 '    data for upper case charcters
1070 DATA 0,51,10,45,32,7,56,55,13,36,52,39,44,33,58,40
1080 DATA 53,34,41,50,35,54,48,49,57,63,38,0,46,47,59,0
2000 '
2010 '    variable assignments
2020 '
2030 '    case = UPPER or lower case
2040 '    INCHAR = value of character input from port
2050 '    L(X) = lower case character set
2060 '    PORT = port location value
2070 '    U(X) = UPPER case character set
2080 '    X = one time variable for set up
3000 '
3010 '    data statements - lower case LTRS (see line 1030)
3020 '
3030 '    NULL,E,LF,A,SPACE,S,I,U,CR,D,R,J,N,F,C,K
3040 '    T,Z,L,W,H,Y,P,Q,O,B,G,FIGS,M,X,V,LTRS
3050 '
3060 '    data statements - upper case FIGS (see line 1070)
3070 '
3080 '    NULL,3,LF,-,SPACE,BELL,8,7,CR,$,4,',COMMA,!,:,(,
3090 '    5,",),2,#,6,ZERO,1,9,?,&,FIGS,.,/,;,LTRS
3100 '    note that the FIGS and LTRS are case independent,
3110 '    they are the same in both upper and lower case
```

Program listing.

figures). If a space character is received, then the case label value is set for lowercase. This feature is called "downshift on space" and may be deleted if the feature is not desired. The last function of the program prints the translated character and loops back for the next character.

The data statements are the actual translated characters. Since Baudot/Murray code is limited to five bits in length, if you treat the input as ASCII, the character value is quite low (less than 32). If you print the character value from the array instead of the actual input value, then translation takes place.

While the program may not be the most glamorous, it does provide an insight into some of the tricks used when programming in Basic and the use of the 8250 ACE chip. Table 1 is added so that ASCII RTTY may be copied. No translation of the character set is needed and that program is very simple and straightforward. Table 2 is for those programmers who wish to start off with new ideas.

So, by using Basic, you can see that it is very simple to write a short routine to do almost anything. The maximum speed of this program is bound only to the speed of the Basic and the TU filters. Good luck, and see you on RTTY!

Questions will be answered only when an SASE is sent with the question. You can also find me on CompuServe 70370,523. ■

Walt Becker K1QPS
Box 201
New Castle NH 03854

On the Flip Side

Here's how to add reverse shift to your Kantronics Interface.

After some years of using a Model 15, a home-brew terminal unit, a tape distributor, and a Swan transceiver for RTTY, I got tired of the noise and decided to go modern. I now have a Kenwood TS-120 with the usual beam and linear, and a TRS-80C computer. I am also using a Kantronics Interface with the Kantronics Hamsoft software. I noticed right away that there were a lot of signals that were either hard or impossible to tune in so as to obtain good copy. I also hate the sight and the hot feeling of the wall-type power supplies.

On page 10 of the instruction manual there is a mention that interference or inversion of the code will prevent copy, and the operator should probably try another signal. Pages 15 and 16 of the manual describe modifications that might have to be made to increase audio level or PTT drive. Also described are modifications that are needed with certain makes of transceivers. Then, on page 18, appears the usual warning that the warranty will be void if wiring or repairs "not of our own installation" are done.

About 50 years ago, while installing early electronic gear on submarines at a local shipyard, I was fortunate to have the opportunity of working with some of the inventors and scientists who developed this gear. I have since never been completely satisfied with anything and have changed or altered everything I got my hands on, warranty warnings notwithstanding. So far I have had no trouble with warranties.

The Kantronics Interface does not have a Normal/Reverse switch, which I thought was a mistake. After adding a switch and a hex inverter, I am sure it was a mistake not to have one as original equipment. The lack of 850 or 425 shifts doesn't seem to pose any problem.

After adding the inverter circuit, I found that the many signals that had been either hard or impossible to copy were now usable.

I used one section of a 7404 hex inverter and a single-pole double-throw toggle switch. The 7404 was installed in a socket which was mounted on a store-bought printed circuit. This was attached to the rear panel of the interface with double-sided sticky tape. The toggle switch was mounted in the front panel, as shown in the photo. Press-on letters were used for the Normal/Reverse indication.

The connection between R49 and the demodulator pin on the output connector on the back panel of the interface was opened and routed through the 7404 chip and the toggle switch, as shown in the diagram. Power was obtained from a nearby +5-volt regulated source on the PC board. A nearby ground connection will also be easily found.

Operation is simple. If a signal is hard to tune or impossible to copy, flip the toggle switch and try again. There is, with a normal 170-Hz shift, the possible necessity of moving either the main tuning dial or the RIT control 170 Hz. I find that I copy more stations more easily with the switch in the Reverse position.

To obtain power for the interface without using the nasty little wall supply, I opened up the connection between pins 3 and 4 of the 4-pin mike connector on the rear panel of the unit. I then used the now-vacant pin 4 as a power source, connecting it to the positive terminal of the power-in jack. A piece of 4-conductor shielded mike cable and a similar modification to the mike jack of my TS-120, where I connected pin 4 to a regulated 13-volt bus, completes the power modification and eliminates the need for the wall supply.

A similar modification to my TR-7400-A and my TR-9000 and I am able to get on VHF AFSK in a hurry.

Flip your interface and copy the rest! 73. ■

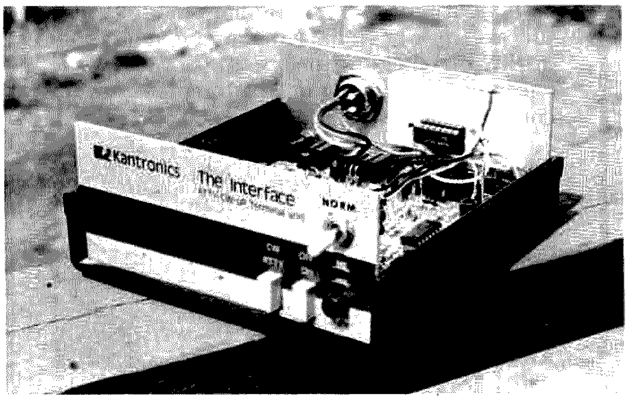


Photo A. The toggle switch is mounted on the front panel.

Parts List

1	Hex inverter	RS 276-1802		$ .79
1	DIP socket	RS 276-1993	(two)	1.29
1	PC board	RS 276-024		1.09
1	SPDT toggle switch	RS 275-326		1.99
1 pc	double-sided sticky tape	RS 64-2343		1.49
			Total	$6.65

Alberto A. Sagues KA4MTO
3406 Thistleton Dr.
Lexington KY 40502

Quash QRM

Add a "RTTY Narrow" position to your TS-520's mode switch—you'll never copy hits again!

Here is a simple modification to the Kenwood TS-520SE that enables you to switch the optional 500-Hz CW filter on or off when the mode-selector knob is in LSB or USB. The performance and flexibility or operation of the rig are not impaired, but RTTY copying is greatly improved.

About one year ago, I became the proud owner of a Model 15 teleprinter and a terminal unit (TU). After making a simple AFSK generator, I started enjoying RTTY operation using my Kenwood TS-520SE transceiver. This was done by inserting the AFSK generator output into the phone-patch input of the transceiver, and transmitting and receiving in LSB. Both the TU and the AFSK generator were tuned to the 2125–2295-Hz tone pair.

A reception problem quickly became apparent. When receiving moderate to weak signals, any other strong signal within the 2.4-kHz sideband passband of the transceiver would activate the agc. This greatly reduced the detected amplitude of *all* other signals within the passband, including the one I wanted to copy. The problem was that the TU was not getting enough input of the desired signal to operate properly, and printing would usually stop. I tried turning the agc off, but that only resulted in unpleasant noises and high audio distortion. Turning the volume control up caused the undesired signal to be limited further by the limiter-input circuit of the TU, but erased the desired signal in the process. Using a passive filter tuned to the center of the tone pair and placed before the TU input helped some, but not much.

There are TUs on the market that can deal with very adverse signal combinations, but they are costly and do not fit within my ham budget. An inexpensive alternative was developed and is described below.

My TS-520SE has the optional 500-Hz CW filter. The filter can be turned on only when the mode-selector switch is turned to the CW position. If that filter could be used with the transceiver in the LSB mode, I thought, the reception problem could be greatly reduced. An examination of the vendor-supplied schematic diagram (which, by the way, lacks some details of the filter switching circuit) and some continuity measurements revealed an easy way of making the narrow filter switchable also in the sideband modes.

The method is as follows: Turn the rig off and unplug it. Carefully turn the transceiver upside-down and remove the bottom cover. The

Photos by Bob Walker KA4NPM

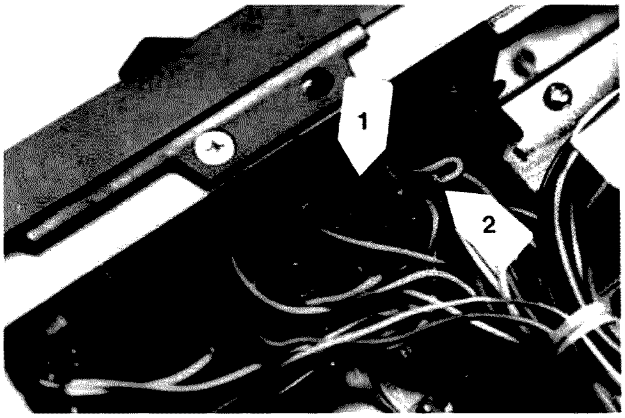


Photo A. Mode switch with modified connections: 1—short between CW and USB lugs; 2—junction of cables B and A; tape has been removed for clarity.

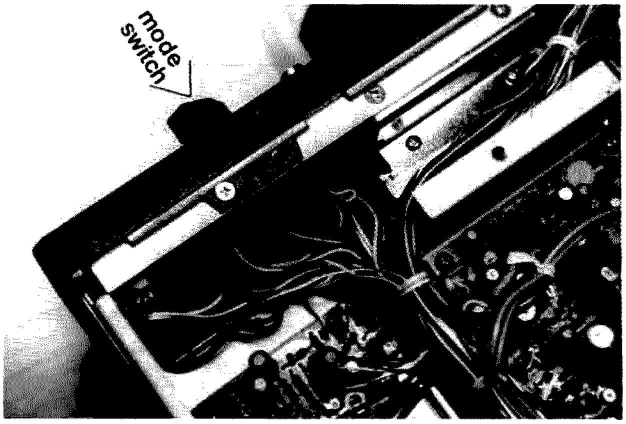


Photo B. The bottom of the TS-520SE showing the position of the mode switch.

mode-selector switch will be exposed. It has five wafers. The connections to be modified are looking straight at you. Locate the center wafer (see Fig. 1). Cable C is orange, and the lug to which it is connected has a voltage of about +14 V with respect to the chassis when the transceiver is turned on. You may want to check this by turning the transceiver on and measuring that voltage. Make sure that the transceiver is on Receive and exercise extreme care not to touch anything else with the voltmeter probe or with your hands. Turn the rig off afterwards and unplug it again; wait until power-supply capacitors have discharged.

Cables A and B are both orange-white. They connect to the LSB and USB lugs, as shown. These lugs are shorted together. Clip both A and B close to their lugs. Solder A to B as shown, and wrap insulating tape around the soldered joint. Make sure that the joined A–B cables do not interfere with the mechanical working of the switch; bend them out of the way.

Next, join the USB and CW lugs with a soldered jumper. This completes the modification. Figs. 1 and 2 show the before and after connections. (My rig has the serial no. 1010379. If yours has different color codes or parts arrangement, you should study the schematic diagram and check connections carefully before attempting the modification.) Now put the bottom cover back on and straighten up the rig.

With the mode-selector switch in LSB and the narrow filter on, tune in a RTTY signal for maximum S-reading. Switch to the wide filter and notice how the background noise and QRM increase dramatically.

The modification lets you switch the narrow filter on while in the LSB or USB mode without impairing any other normal transceiver function. For sideband operation, simply switch the filter to Wide. If you forget and leave the filter switch in the Narrow position and want to use sideband, you will notice it immediately during reception. Transmitting voice with the narrow filter on will result in an unintelligible signal but will not harm the rig. The narrow filter, when switched on, will result in a 500-Hz-wide bandpass, centered at 1500 Hz below the LSB carrier, or at 1500 Hz above the USB carrier.

To benefit from this modification, you will have to retune both the TU and the AFSK generator to an audio-frequency pair within the passband. I chose 1400 Hz for the mark and 1570 Hz for space. Leave the narrow filter on when transmitting with AFSK; its narrow bandwidth helps in putting out a cleaner signal.

The modification has made copying RTTY a pleasure, with QRM reduced to the few instances when another station operates within a couple-hundred Hz of the desired copy.

In summary, a simple modification to the filter-switching connections of the TS-520SE will make the CW filter switchable when in the USB and LSB positions. The modification involves no holes and is easily reversed. The consequent reduction in receiving bandwidth improves copy dramatically under QRM conditions. The modification does not impair the performance or operational flexibility of the transceiver. ■

Note: Kenwood TS-820S users interested in operating that unit in AFSK (instead of FSK) with 500-Hz selectivity are referred to the article by R. Rennaker W9CRC in *CQ*, Vol. 38, No. 2 (February, 1982), p. 38.

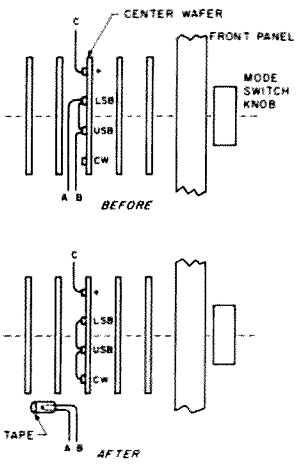


Fig. 1. Mode switch seen from the bottom of the transceiver. Wiring modifications.

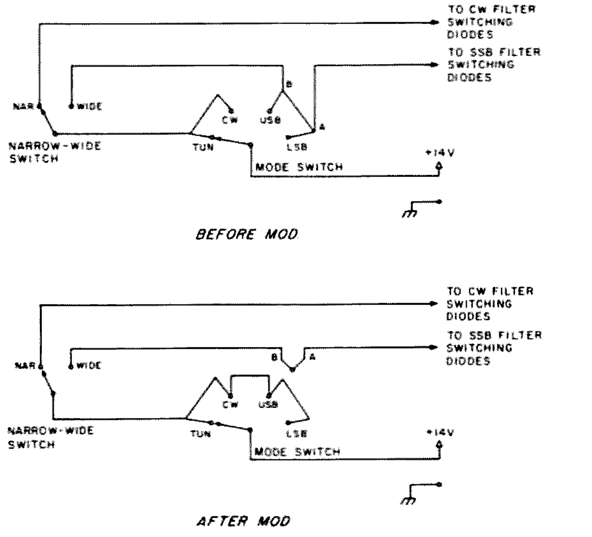


Fig. 2. Schematic of the filter switching circuit before and after modification.

Joseph A. Ryan WB5LLM
PO Box 622
Florence MS 39073

The D-Day Demodulator

When the CV-89A joins forces with your micro, you'll take the RTTY bands by storm!

I am writing this as a result of a letter I sent to Dr. Marc Leavey WA3AJR's "RTTY Loop" column in *73*, June, 1983. It seems the procedure I used to get my computer interfaced to the receiver was of some interest. I don't think I'll alienate any of the high-tech manufacturers of RTTY demodulators with this idea.

This, incidentally, is not a review of a piece of 25-year-old equipment that got lost on the editor's desk. This is, after all, supposed to be a hobby, and although many of us like (and can afford to buy) the latest, state-of-the-art equipment, there are still plenty of hams that either don't want to spend all that money, or can't . . especially for their hobby. I started in amateur RTTY back in the late 40s; my first printer was an old Model 12 "rock crusher" and my first demodulator was a homebrewed W2JAV converter. Eventually, via the surplus market, I obtained a surplus CV-89A/URA-8A frequency shift converter. I, like many others, became inactive for a while and when I finally got back into ham radio and interested in RTTY again, lo and behold, we had microcomputers, software, and all those goodies.

When I obtained my very first micro, a Tandy Corporation TRS-80(C) Color Computer®, and bought a copy of Clay Abrams K6AEP's RTTY software, I was all in a rush to get it on the air. Rummaging around, I resurrected the CV-89 and started to see how it could be linked to the RS-232 I/O of the CoCo. After all, the CV-89 was designed to use the old standard 130-V-dc, 0.60- or 0.20-mA loop, and that wouldn't do. Therefore, I designed the resulting interface. That's what this is all about. I won't claim that the CV-89 will pull signals out of the noise level like some of the newer high-tech demodulators are supposed to do, however, it does offer the following:

- Can copy any shift from 10 to 1000 Hz and all in between
- Can copy any speed from 45 baud to at least 300 baud, either Baudot, ASCII, or what have you
- Has a Normal/Reverse switch
- Has a Tune/Operate switch to lock up the print when tuning
- Has a two-inch scope for tuning that RTTY signal that does *not* use the usual cross pattern
- Has a Threshold control for no-signal lockup
- Has separate Narrow and Wide shift 500-Ohm inputs
- Is designed for rack mounting but can stand alone, 19" × 5.5" × 15"
- Has 17 tubes, including the scope

For the going prices at most hamfest flea markets or from some of the remaining surplus radio suppliers, usually between $50.00 and $85.00, what could be better?

I should warn you at this time that one of the tubes used, the 1Z2, is to my knowledge in very short supply. However, since it's a diode used as a high-voltage rectifier for the scope, and mine went west several years ago, it can be replaced, with some loss of focus on the scope, with any silicon diode with a 1000-V piv rating. At the time of writing, the scope, the CV-89, and the 1Z2 were all available from Fair Radio Sales of Lima, Ohio. However, the designers of this unit saw the possibility of this scope tube being in short supply and made provisions for an external connector on the rear apron that can be used to connect any oscilloscope. This will give the same display pattern, so loss of the scope tube (a 2BP1) is not serious.

Let's get down to the important part, the interfacing of this unit to the TTL I/O of a computer's RS-232. That RS-232 doesn't want to see more than 10 V dc, and the keyer tube of the CV-89 is designed to switch 130 V dc. What to do? Well, the prob-

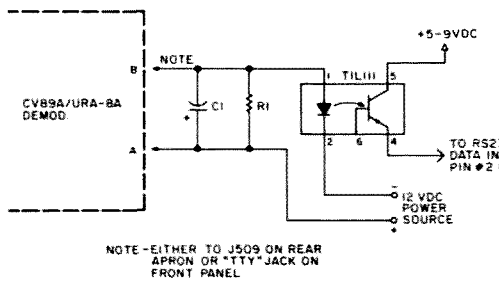


Fig. 1. Schematic.

lem is solved with the use of an Opto-Coupler (I used a Radio Shack TIL-111) and a 12-V-dc power supply. Yep, the 6AQ5 keyer will nicely switch the 12 V dc and deliver 0.20 mA to the LED side of the Opto-Coupler (which is what it wants to see, anyway). (See Fig. 1.) I added an RC circuit to compensate for some leading-edge bias on the signal caused by the low plate voltage (I found that 100 uF @ 10 V dc and 120 Ohms work best). On the TTL output of the Opto-Coupler, I used 9 V dc and connected it to the input of the RS-232. Presto! It's been working fine for the last year and I can copy anyone I can hear, at any shift (and believe me, they vary all over the place) and any speed from 45 baud to 300 baud ASCII (not much of that on right now).

A little more about the CV-89, itself. All the tubes in it (except the 1Z2 and the scope) are standard off-the-shelf items like 12AX7s, 12AU7s, 6AQ5s, 6AL5s, and 0A2s, and all the other components (except the filter coils) are standard resistors and capacitors, so don't be afraid of it. All these parts are going to be around for awhile. I should mention that the CV-89 comes (usually) with a blower and a thermal switch designed to cut in at 120° F; however, in over 10 years of use, it has never cut in (I even checked it out by purposely heating the thermal switch up, and it worked).

Maybe this is not a lash-up that is state of the art, but in all the years of use, the CV-89 has not lost a tube (except the 1Z2) and is still in use. I know that many hams pooh-pooh tubes these days, and I know it's a bit bigger than the small solid-state demodulators, but it works as well and it's inexpensive. Try one . . . you may be surprised! ■

Terry Pelkola KW9L
35 N. Illinois
Villa Park IL 60181

Slick VIC Trick

Here's the cheapest way we know of to add a printer to your VIC-20. First, find a Model 33...

A couple of years ago I had a chance to buy a Teletype® Model 33 ASR. I had previously purchased a VIC-20 and when I was told the 33 was also an ASCII device, I figured it could be used as a printer (somehow!). I had read the programmer's guide[1] enough to know that there was a user's I/O (input/output) port and a built-in RS-232 interface. First I built a teletype interface and then tried to get it to work. I'll tell you how I did it and in the process try to explain the mysteries of the user's I/O port. The Model 33 is now usable to both run and list programs. Except for slow speed, no graphics, and noise, it's a perfect printer. (Well, what do you expect for $50?)

When I bought the Model 33, I only knew it was 110 baud and had a 20-mA loop to operate the print magnets. If I had had any idea that I would need to know how many stop bits were required, as well as parity, word length, and if full or half duplex, I don't think I would have started the project. But getting there was half the fun.

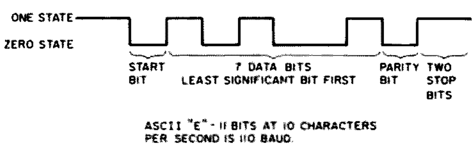


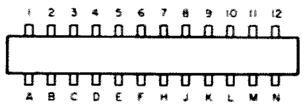
Fig. 1.

Since then, I have found a book[2] that explains the teletypewriter data format (see Fig. 1). As you can see, there is a start bit, seven data bits, a parity bit, and two stop bits for each character. The VIC I/O port must translate each ASCII character to this format and operate our external device (a transistor switch) to interrupt the 20-mA loop in this pattern to print each character. It sounds like a lot of work but the biggest share is done by a smart I/O chip called a VIA (versatile interface adapter). This chip will format inputs and outputs to the VIC in serial or parallel format (the 33 is serial). Also, it automatically takes care of those pesky stop bits, etc.

The VIA uses the bottom side of the user I/O port. The arrangement is shown in Fig. 2. We will be using a serial device so we will only need to operate a switch to make the printer work. We will use contact M, called CB2. This is called the three-wire mode since only three wires, a send, a receive, and a common, are needed. Of the three, we will use only the send (CB2) and the common. Receive would be through CB1 and common.

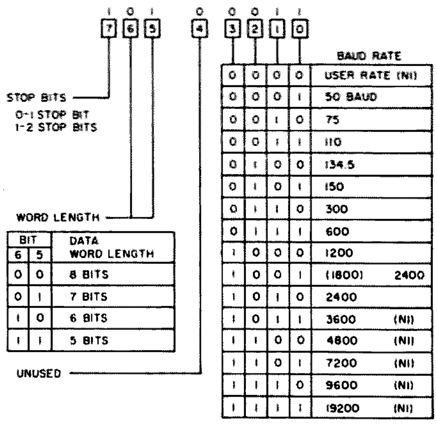
You must do two things to get the port to operate. First, you must tell the computer you want to direct data through the port. To do this, the Basic command, Open, is used. This command has the format: Open file #, device #, command #, and string. The Open command will be as shown on line 10 in the program listings.

Our Open command will use file number 200. Any file



Pin #	Type	Note	Pin #	Type
1	GND		A	GND
2	+5V	100 mA max.	B	CB1
3	$\overline{\text{RESET}}$		C	PB0
4	JOY0		D	PB1
5	JOY1		E	PB2
6	JOY2		F	PB3
7	LIGHT PEN		H	PB4
8	CASSETTE SWITCH		J	PB5
9	SERIAL ATN IN		K	PB6
10	+9V	100 mA max.	L	PB7
11	+9V		M	CB2
12	GND		N	GND

Fig. 2.



BIT 6	BIT 5	DATA WORD LENGTH
0	0	8 BITS
0	1	7 BITS
1	0	6 BITS
1	1	5 BITS

3	2	1	0	BAUD RATE	
0	0	0	0	USER RATE (NI)	
0	0	0	1	50 BAUD	
0	0	1	0	75	
0	0	1	1	110	
0	1	0	0	134.5	
0	1	0	1	150	
0	1	1	0	300	
0	1	1	1	600	
1	0	0	0	1200	
1	0	0	1	(1800)	2400
1	0	1	0	2400	
1	0	1	1	3600	(NI)
1	1	0	0	4800	(NI)
1	1	0	1	7200	(NI)
1	1	1	0	9600	(NI)
1	1	1	1	19200	(NI)

Fig. 3.

number from 1 to 255 could be used but numbers above 127 generate an automatic line feed after the carriage return. Because of the line-feed generation, no buffer or handshaking is needed.

The next number, 2, is the device number that says it's an RS-232 device. This turns on CB2 for us. The third 2 is the command number and has no effect on our printer. The string at the end is the real workhorse and was the hardest to figure out. The first part, CHR$(163), directs the VIA's control register. It tells the speed and format of the serial ASCII data. 163 in decimal is 10100011 in binary.

Fig. 3 shows the control-register format with our bit pattern for 163 above it. As you can see, we are telling it to use two stop bits, a seven-bit word length, and a 110-baud rate. The second part of the string is CHR$(220). This is automatically peeled off and used to control the command register. 220 in decimal is 11011100 in binary. Fig. 4 shows the command-register format with our bit pattern above it. You can see there is parity disabled, half duplex, and we are using the three-line mode.

The only other line we need is line 20 in program listing 1. Get A$ will check what would normally go to the screen and hold it for the CMD(200). The CMD(200) says take the data which would normally go to the screen and send it to file 200. Check back to our first line and you will see we made file 200 the RS-232. That's it! I start my programs like that:

I use 100 for my first actual program line number. When I RUN, the output will go to the printer instead of the screen. To save paper, use RUN 100 to bypass the printer instructions and use the screen as always. After a RUN, type LIST and your program will list on the printer. If you have a lengthy printout and you want to test the program or just want a listing, put a line 30 STOP and then RUN the program. The printer will just print BREAK IN LINE 30 and you may then list the program by typing LIST.

The interface I used is shown in Fig. 5. The circuit was taken from a *QST* design.[3] I used this circuit because, with proper programming, the optoisolator would allow inputting the VIC by typing on the 33 when the VIC was used in the three-wire mode. This might be useful for a printer remote from the shack or for a two-operator station. For use as a printer only, the optoisolator is not needed.

The 20-mA loop in the 33 may be hard to find. I found mine by tracing the wires, opening the circuit, and metering the 20-mA current. Of course, asking someone who knows and can show you is always the best way!

```
10   OPEN 200,2,2,CHR$(163) + CHR$(220)
20   GET A$:CMD(200)
100  PRINT "WHAT IS YOUR NAME?"
110  INPUT N$
120  PRINT N$
130  PRINT "WHERE DO YOU LIVE?"
140  INPUT L$
150  PRINT L$
160  END
```

Program listing 1.

```
10   OPEN 200,2,2,CHR$(163) + CHR$(220)
20   OPEN 3,3
30   GET A$
100  CMD(3)
110  PRINT "WHAT IS YOUR NAME?"
120  CMD(200)
130  INPUT N$
140  PRINT N$
150  CMD(3)
160  PRINT "WHERE DO YOU LIVE?"
170  CMD(200)
180  INPUT L$
190  PRINT L$
200  END
```

Program listing 2.

```
10  OPEN 200,2,2,CHR$(163) + CHR$(220)
20  GET A$:IF A$ ""THEN 20
30  IF A$ CHR$(13) THEN PRINT CHR$(10):CMD(200)
40  PRINT#200,A$;:GOTO 20
```

Program listing 3.

When you get your interface built, try the program in listing 1 to test your new printer. Type RUN and the first question will come up on the screen and be printed on the 33. When you type your answer, note that you retain all the features of the screen editor like DELETE and INSERT. Your run should look like this:

WHAT IS YOUR NAME?
(Your name)
WHERE DO YOU LIVE?
(Your town)

The program may be listed by typing LIST. Also try RUN 100 to get the feel of manually bypassing the printer instructions.

For an expanded sample, try the program in listing 2. This program acts as a print switcher. It prints both the questions and answers on the screen but only the answers on the 33. I have modified a code contest program to print a log of all contacts on the 33 and return to the VIC automatically to con-

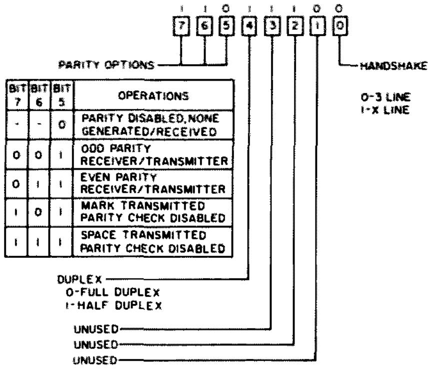


Fig. 4.

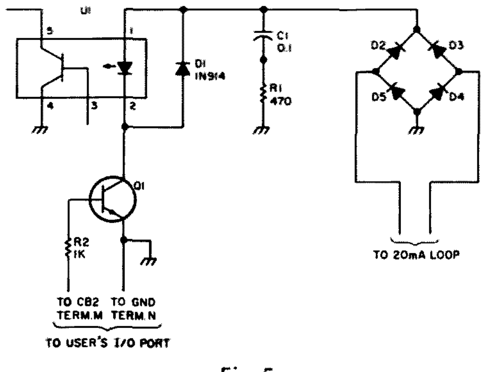


Fig. 5.

tinue the code-generating portion of the program.

For a last example try the program in listing 3. This will allow you to type on the VIC and have the text print on the 33. This might be useful with a RTTY program and would give you hard copy of both the send and receive from the VIC keyboard.

I hope this will give new life to a 33 in someone's basement corner. Maybe that 33 at the next hamfest won't look quite so antique! Don't be afraid to experiment with the user I/O port, just keep in mind that it is at TTL levels instead of the normal RS-232 levels of plus and minus 15 volts. I also hope this information on the user I/O port will spur you on to use the computer for other projects. In the meantime, you have a cheap printer for the VIC.■

References

1. *VIC 20 Programmer's Reference Guide*, A. Finkel, N. Harris, P. Higginbottom, and M. Tomczyk, Commodore Business Machines, Inc., and Howard W. Sams and Co., Inc., 1982.
2. *6502 Assembly Language Programming*, Lance A. Leventhai, Osborne/McGraw-Hill, 1979.
3. "A State-of-the-Art Terminal Unit for RTTY," Michael J. DiJulio WB2BWJ, *QST*, December, 1980.

Parts List

C1—0.1 μF, 50 V disc
R1, 2—¼ Watt
D2—1N914
D2, 3, 4—1N4003
Q1—2N5655, MJE340, TIP-48, or ECG198
U1—OPI-2150, HEP-P5000, or Motorola 4N28
Misc.—DIP socket, transistor socket, perfboard, etc.

Terry Lyon KA3GCQ
3 McCann Street
Edgewood MD 21040

QSK for Your Vintage Vfo

All it takes is an hour.

Want a vfo modification which gives you full break-in keying and takes about one hour to install? It worked wonders for my vintage 1948 vfo. Well, read on! I have a simple circuit which can remotely alter the output frequency of Hartley- and Colpitts-type oscillators. The frequency can be shifted at normal CW keying rates and the difference in frequency can be several thousand Hertz.

The circuit was developed to bring an antique vfo (Millen type 90711) out of mothballs and place it into active service. As with many older style units, this vfo had to be switched into the standby mode while listening to the other side of a CW conversation to avoid an annoying heterodyne whistle. The whistle resulted from fundamental or harmonic emissions coming from the oscillator. When reenergized, the oscillator had a tendency to drift until its temperature had restabilized. This old vfo could also be operated as a keyed oscillator (i.e., the oscillator could be turned on and off when keying the transmitter). As expected, keying the oscillator provided a truly wretched chirping output signal which was not very useful.

Many amateurs have known that it is better for the sake of stability to let an rf oscillator run all the time. However, it is next to impossible to completely shield the oscillator compartment to prevent leakage of fundamental and harmonic frequency components. Thus some interference to the station receiver will remain. A more practical solution involves shifting the vfo to a new frequency which does not create severe reception difficulties. Although several circuits exist which can shift a vfo's frequency, many are not well suited for full break-in CW keying.

Fig. 1 illustrates an rf switching circuit and its connections to a typical multistage vfo or master oscillator/power amplifier transmitter. This circuit is controlled by the key to shift the oscillator frequency at a normal keying rate. It can be added to many vfo's without much revision since it is connected in parallel with the existing components. Control voltage for the circuit was derived from the key connections inside my vfo. When the key was up, slightly over 100 volts appeared across my key contacts. This voltage is used to bias a solid-state rf switch into conduction with R2. The rf switch consists of D1, Q1, R1, and C1. When the key is up, as for receiving, capacitance from C1 is added across the oscillator's tuned circuit, which was tuned near the 160-meter band in my case. When transmitting, the net capacitance of the rf switch drops to a minimum. Hence, when transmitting, the vfo frequency should return to nearly the same frequency as for the unmodified vfo, thereby maintaining the original dial calibration.

A rigid arrangement should be used for the sake of stability. I located the components adjacent to the tuned circuit. Component leads were soldered directly together to minimize stray capacitance. An NPN transistor was selected in my rig as in Fig. 1 since the keyed voltage was positive. However, D1 could be reversed and Q1 could be a PNP type if a negative voltage were present.

I found that it was not necessary to realign the vfo oscillator after modification. The intrinsic shift created by this circuit when the key was down was slight as expected. However, if the circuit does not move the oscillator outside the receiver's passband when shifted, the value of C1 may need to be increased, but not by much. Increasing the capacitance of C1 can cause a larger drop in the oscillator frequency. However, too much capacitance may stop the oscillator altogether, which is very undesirable and may be damaging.

The shifter is easy to use. Firstly, open switch S1 to locate the oscillator fundamental or harmonic emission with your receiver (SPOT). Next, tune the vfo to zero beat its emission with an incoming CW signal or just set it to a comfortable tone (inside the band limits, of course). Lastly, close S1 and you are ready to transmit (OPERATE). Be sure to either use a separate antenna or fast-acting antenna switch for the receiver to keep the smoke to a minimum in your shack.■

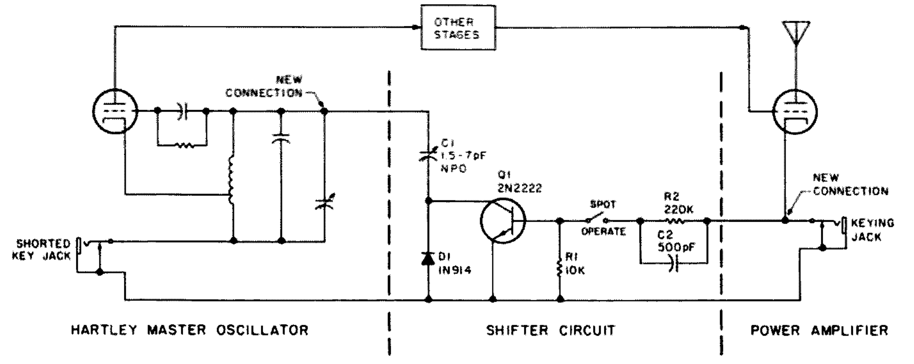


Fig. 1. Simple add-on circuit to shift vfo frequency at normal CW keying rates for full break-in keying.

BARTER 'N' BUY

Individual (noncommercial) .... 25¢ per word
Commercial .... 60¢ per word

Prepayment by check or money order is required with your ad. No discounts or commissions are available. Please make your payment to *73*. Rates for multiple insertions are available on request.

Advertising must pertain to amateur radio products or services. No special layouts or positions are possible. All advertising copy must be submitted typewritten (double-spaced) and must include full name and address. Copy limited to 100 words, maximum. Count only words in text. Address, free.

73 cannot verify advertising claims and cannot be held responsible for claims made by the advertiser. Liability will be limited to making any necessary corrections in the next available issue.

Copy must be received in Peterborough by the 5th of the second month preceding the cover date.

Make checks payable to *73* Magazine and send to: Ross Kenyon, Advertising Department, *73* Magazine, 80 Pine Street, Peterborough NH 03458.

MOBILE IGNITION SHIELDING. Free literature. Estes Engineering, 930 Marine Drive, Port Angeles WA 98362. BNB006

MILITARY TECHNICAL MANUALS for old and obsolete equipment. 60-page catalog, $3.00. Military Technical Manual Service, 2266 Senasac Ave., Long Beach CA 90815. BNB045

NEW HAM-SWL SOCIETY for unity of thought & learning. Open to all. Many topics, awards, free ad space in periodical, society net, museum participation. Shack pics & QSLs welcome. Writers needed. SASE for info to RCSW, 32 Applegate, Bennington VT 05201. BNB197

HAM RADIO REPAIR, tube through solid state. Robert Hall Electronics, PO Box 8363, San Francisco CA 94128; (408)-729-8200. BNB219

QSLS to order. Variety of styles, colors, card stock. W4BPD QSLs, PO Drawer DX, Cordova SC 29039. BNB260

THE DX'ERS MAGAZINE. Up-to-date, informative, interesting. Compiled and edited by Gus Browning W4BPD, DXCC Honor Roll Certificate #4. Send for *free* sample and subscription information today. PO Drawer DX, Cordova SC 29039. BNB261

CASH PAID for traffic/speed radar equipment. Write or call: Brian R. Esterman, PO Box 8141, Northfield IL 60093; (312)-251-8901. BNB271

KENWOOD 430S owners only! Stop Scan—when the squelch breaks, the scan stops! Adjustable resume scan delay. No modifications! Kit $25, assembled $35. JABCO, R1 Box 386, Alexandria IN 46001. BNB275

WHY SELL IT? You can donate that unwanted equipment, get the tax break, and feel like a million. Contact the kids learning English via amateur radio at Junior High 22 on Manhattan's Lower East Side. WB2JKJ, Junior High School 22 ARC, 111 Columbia Street, New York NY 10002. BNB276

COPY SATELLITE PHOTOGRAPHS, weather maps, and press on our military-surplus facsimile recorders. Recorders are solid-state, dual-speed, and fully automatic. Catalog available. Atlantic Sales, 3730 Nautilus Ave., Brooklyn NY 11224; (718)-372-0349. BNB280

DIGITAL AUTOMATIC DISPLAYS for FT-101s, TS-520s, Collins, Swan, and all others. Six 1/2" digits in a 5" wide by 1-1/2" high and 9" deep metal cabinet. Send $1.00 for information. Grand Systems Dept. A, PO Box 3377, Blaine WA 98230. Canadians contact VE7LB. BNB282

$$$$$ SUPER SAVINGS on electronic parts, components, supplies, and computer accessories. Free 40-page catalog for SASE. Get on our mailing list. BCD Electro, PO Box 830119, Richardson TX 75083; (214)-690-1102. BNB289

ATLAS 350XL OWNERS GROUP. Free newsletter. Send QSL with rig s/n and SASE. Know people who repair them? Information to share? Questions? Rod N5NM, Box 2169A, Santa Fe NM 87501. BNB291

ROHN TOWERS—Wholesale direct to users. 23% to 34% discount from dealer price. All products available. Write or call for price list. Also, we are wholesale distributor for Hellax antenna cable. Hill Radio, 2503 G.E. Road, PO Box 1405, Bloomington IL 61701-0887; (309)-663-2141. BNB293

1985 "BLOSSOMLAND BLAST," Sunday, October 6, 1985. Write "BLAST," PO Box 175, St. Joseph MI 49085. BNB296

CODE-PRACTICE PROGRAMS diskette for IBM PC, PCjr. $10 pp. Andrew Modla/73, 5 Derby Place, Newtown PA 18940. BNB306

HIGH-QUALITY, LOW-COST courtesy beepers for your transmitter or repeater. Kit $14, assembled $18 F.O.B. YBM Enterprises, 8502 N. Oketo Ave., Niles IL 60648. BNB309

FIND OUT what else you can hear on your general-coverage transceiver or receiver. Join a shortwave radio listening club. Complete information on major North American clubs and sample newsletter, $1.00. Association of North American Radio Clubs, 1500 Bunbury Drive, Whittier CA 90601. BNB310

COMMODORE 64 5-Band DXCC Log includes custom beam beadings and distances to DX, plus continent, country, zones QSOed/QSLed on any band, phone or CW, upon country name or callsign entry. Diskette and instructions $18.99 US ppd. Sondor Software, PO Box 416, Sarnia, Ontario, Canada N7T 7J2. BNB313

FULL-FEATURED RTTY/ASCII/CW software package for TRS-80 Model III/4. Write for free information package. Clifton J. Turner WB5KCQ, 6319 Boeuf Trace, Alexandria LA 71301. BNB319

CX7 REPAIRS. Mark Mandelkern, 2315 Derby St., Berkeley CA 94705; (415)-549-9210. BNB320

DX ADVENTURE on Montserrat, only $250/week. Details: Chod Harris VP2ML, Box 4881-7, Santa Rosa CA 95402. BNB321

SATELLITE TRACKING program with hi-res color graphics for the Commodore 64. Plots antenna pointing angles and satellite ground track. Save graphics to printer, disk, or tape. $14.95 ppd. on tape or disk. David Eagle, 7952 W. Quarto Dr., Littleton CO 80123; (303)-972-4020. BNB322

WANTED: old tubes, speakers, amplifiers, by Western Electric, RCA, Cunningham, DeForrest, McIntosh, Marantz, Quad, Altec, JBL, Tannoy. Maury, 11122 Atwell, Houston TX 77096; (713)-728-4343. BNB323

WHEELING WV HAMFEST and Computer Fair, Wheeling Park, Sunday, July 21. Dealers most welcome, all under roof. Five-acre flea market. ARRL, AMSAT, SWOT, SMIRK booths. Park, family activities available. Admission $3.00. To reserve space, contact Jay Paulovicks KD8GL, RD 3 Box 238, Wheeling WV 26003; (304)-232-6796, or TSRAC, Box 240 RD 1, Adena OH 43901; (614)-546-3930. BNB324

C-64 SOFTWARE: Morse keyboard program w/color & sound. Also, slow-speed Morse teacher. Kids really like this one! Both for $10.00 on high-quality disk or tape. No CODs. Glen E. Gardner, Jr., PO Box 387, Chillicothe OH 45601. BNB325

IMRA—International Mission Radio Association. Forty countries, 800 members. Assists missionaries with equipment loaned, weekday net. 14.280 MHz, 2:00-3:00 pm Eastern. Brother Bernard Frey, 1 Pryer Manor Road, Larchmont NY 10538. BNB326

FREE: 100 QSLs with first order. Samples 50¢. Gazebo Press, Rt. 4 Box 4148, LaPlata MD 20646. BNB327

HEAT SINK—U drill and save, $3.00-$5.00 each on most popular styles. Custom drilling 75¢ and up. Send $1.00 for prices and specs to Heat Transfer Research, Dept. H1, PO Box 6223, Tehachapi CA 93561. BNB328

THE CODE SOLUTION for the Commodore 64. Learn code through randomly-sent letters and numbers. Select speeds from 5-13 wpm. Diskette $12.99, cassette tape $11.99. Add $2.00 shipping and handling. NJ residents add 6% sales tax. Software Solutions, Box 1663, Dover NJ 07801. BNB329

ELECTRON TUBES: receiving, transmitting, microwave...all types available. Large inventory means next-day shipment in most cases. Daily Electronics, PO Box 5029, Compton CA 90224; (213)-774-1255. BNB330

PERSONALIZED HAM SHACK MEMO PADS—cheap as paper. Free information. Words Plus, Dept. 71, 35 E. Golf Terrace, Arlington Heights IL 60005. BNB331

WANTED: radios, tubes pre-1939 for my collection. Howard Stone, HCR-3, Box 418, Deer River MN 56636. BNB332

SPECIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices, 73 Magazine, Pine St., Peterborough NH 03458.

BLACKSBURG VA
MAY 30—JUN 1

Virginia Polytechnic Institute and State University will hold a workshop, Personal Computer and STD Computer Interfacing for Scientific Instrument Automation, on May 30–June 1, 1985, at Virginia Tech, Blacksburg VA. The hands-on workshop, directed by Mr. David E. Larsen and Dr. Paul E. Field, is $450.00 for three days. Participants will be wiring and testing interfaces. For more information, write Dr. Linda Leffel, CEC, Virginia Tech, Blacksburg VA 24061, or phone (703)-961-4848.

SEASIDE OR
MAY 31–JUN 2

The North Coast Repeater Association and the Oregon Tualatin Valley ARC will sponsor the fifth annual Oregon State Ham Convention from May 31, 1985, through June 2, 1985, at the Seaside Convention Center, Seaside OR. The convention hall hours will be: Friday, May 31—5:00 pm to 8:00 pm; Saturday, June 1—8:00 am to 5:00 pm; Sunday, June 2—9:00 am to about 2:00 pm. The convention will feature commercial/dealer exhibits, seminars, VE testing, a flea market, and a banquet. For more information, contact OTVARC, PO Box 5132, Beaverton OR 97006.

LOVELAND CO
JUN 1

The Northern Colorado Amateur Radio Club will hold Superfest 7 on Saturday, June 1, 1985, at the McMillen Building, Larimer County Fairgrounds, Loveland CO. Admission is $3.00. Events include a code contest and packet radio. Doors open at 8:30 am. There will be food and commercial exhibitions available. Talk-in on 146.25/.85 and 147.795/.195. For more information, contact Rick Hubbard WAØDDC at (303)-353-8366, or Gus Fox WØEE at (303)-330-9012.

ST. PAUL MN
JUN 1

The North Area Repeater Association will sponsor a swapfest and exposition for amateur-radio operators on Saturday, June 1, 1985, at the Minnesota State Fairgrounds, St. Paul MN. Admission is $4.00 in advance and $5.00 at the door. Exhibits, commercial dealers, VE exams, and a giant outdoor flea market will be featured. There will be free overnight parking for self-contained campers on May 31. Talk-in on .25/.85 and .16/.76. For more information or for advance tickets, write to Amateur Fair, PO Box 857, Hopkins MN 55343; (612)-566-4000.

NH/VT NEIGHBORS DAY
JUN 1

Special-event station W1GUA will be operated from Fort Number 4 in Charlestown NH on June 1, 1985, from 10:00 am to 5:00 pm, to mark New Hampshire/Vermont Neighbors Day. The multi-operator station will be operating 25 kHz up from the bottom of the General portion of the 80-, 40-, and 15-meter CW and phone bands, as well as 2-meter simplex and packet radio. For a commemorative QSL, send a business-size SASE and QSL to Rudy Adler W1GUA, Dodge Hollow Road, Lempster NH 03605, or to WB1GXM, PO Box 428, Claremont NH 03743.

MIDLAND MI
JUN 1

The Central Michigan Amateur Repeater Association will sponsor the 11th annual Midland Hamfest on Saturday, June 1, 1985, from 8:00 am to 2:00 pm, at the Midland Civic Arena, Midland MI. Admission is $3.00 in advance and $4.00 at the door. Tables are $8.00 for a full table, $3.00 for a half table, and trunk sales are $3.00. Setup begins at 6:00 am. Free parking and handicapped parking will be available. VE license exams will be given. Refreshments will be available. Talk-in on 147.60/.00 and 146.52. For advance tickets or more information, contact Raleigh L. Wert W8QOI, 309 E. Gordonville Road, Route 12, Midland MI 48640; (517)-631-5591.

GRAND RAPIDS MI
JUN 1

The Independent Repeater Association of Grand Rapids will hold its annual Hamfestival on June 1, 1985, from 8:00 am to 4:00 pm, at the Wyoming National Guard Armory on 44th Street, west of US-131. Admission is $3.50. Programs include satellite operation, packet radio, a CW copying contest, a shack picture contest, entertainment films for non-hams, and more. There will be a 15,000-square-foot indoor swap area and table space is free for all sellers. Dealer setup begins at 6:00 am. Talk-in on .165/.765. For more information or for table reservations, call Paul Gardner WD8IZB at (616)-538-8241 or write to IRA, 562 92nd Street SE, Byron Center MI 49315.

OHIO WINE MONTH
JUN 1–2

The Wireless Institute of Northern Ohio (WINO) will commemorate Ohio Wine Month by operating special-event station KO8O on Saturday, June 1, 1985, from 7:00 pm to 11:00 pm, on 3860 and 7235 kHz, and on Sunday, June 2, 1985, from 11:00 am to 3:00 pm, on 7235 and 14,235 kHz. The station will be located at a winery in Madison OH. For an 8½ × 11 certificate, send a legal-size SASE to: KO8O—WINO Weekend, 7126 Andover Drive, Mentor OH 44060.

HARRY'S HEYDAYS
JUN 1–2

The Southside Amateur Radio Club will operate special-event station NØEWP on June 1–2, 1985 (Harry's Heydays), in honor of President Harry S. Truman's 101st birthday, from near the old Truman farm home in Grandview MO. The station will be on 7235 and 14235 (±QRM). The times of operation will be: June 1, 1700–2400 UTC; June 2, 0001–0400 UTC and 1700–2200 UTC. A commemorative certificate will be available for a 9 × 12 SASE and 33 cents postage. QSL to: Southside Amateur Radio Club, PO Box 412, Grandview MO 64030.

COLUMBUS OH
JUN 2

The Battelle ARC will sponsor the fifth annual Ohio Hamfest on Sunday, June 2, 1985, from 8:00 am to 3:00 pm, at the Ganyard building on the Franklin County Fairgrounds, Columbus OH. Admission is $2.00 in advance and $3.00 at the door. Tables are $3.00 in advance and $4.00 at the door. Talk-in on 146.37/.97. For advance sales, send an SASE to Bill Welch W8LLU, 396 Brevoort Rd., Columbus OH 43214. For more information, call Bill W8LLU at (614)-261-7053 or Kevin WA8OHI at (614)-766-5313.

PITTSBURGH PA
JUN 2

The 31st annual Breeze Shooters Hamfest will be held on Sunday, June 2, 1985, from 9:00 am to 5:00 pm, at the White Swan Amusement Park, PA Route 60 (Parkway West), near the Greater Pittsburgh International Airport. There will be a flea market and family amusement park. Sheltered tables are available by advance registration. Talk-in on 146.28/.88 or 29.000. For further information, contact John Colbert K3SDL, 1831 Highland Avenue, Irwin PA 15642; (412)-863-5167 evenings.

HUMBOLDT TN
JUN 2

The Humboldt Amateur Radio Club will sponsor its annual hamfest on June 2, 1985, from 8:00 am to 4:00 pm, at Bailey Park, 22nd Avenue, Humboldt TN. Admission is $2.00. Features include a flea market, food, parking for RVs (electricity provided, water close by), and alternate activities. Talk-in on .37/.97. For more information, contact Ed Holmes W4IGW, 501 N. 18th Avenue, Humboldt TN 38343.

CHELSEA MI
JUN 2

The Chelsea Swap and Shop will be held on Sunday, June 2, 1985, from 8:00 am to 2:00 pm, at the Chelsea Fairground, Chelsea MI. Admission is $2.50 in advance and $3.00 at the door. Children under 12 and non-ham spouses will be admitted free. Setup begins at 5:00 am. Talk-in on 146.520 simplex and 147.255 (Chelsea Repeater). For more information or advance tickets, contact William Altenberndt, 3132 Timberline, Jackson MI 49201.

PRINCETON IL
JUN 2

The Starved Rock Radio Club will sponsor a hamfest on June 2, 1985, in Princeton IL. Admission is $2.50 in advance (before May 20) and $3.00 at the door. VE exams will be given and no pre-registration is required. For exam details, send a long SASE to Denny R. Chestney KM9L, 1212 Dogwood, Bloomington IL 61701. For complete hamfest information, contact W9MKS, RFD #1, Box 171, Oglesby IL 61348; (815)-667-4614.

TERRE HAUTE IN
JUN 2

The 39th annual Wabash Valley Amateur Radio Hamfest will be held on Sunday, June 2, 1985, beginning at 8:00 am, at the Vigo County Fairgrounds on US 41, ½ mile south of I-70, Terre Haute IN. Admission is $2.00 in advance (3 for $5.00) or $3.00 at the gate. Children under 12 are free. Covered flea-market spaces are $3.00 for a 12 by 12 space. The outdoor flea market is free. Some tables and ac power will be available on a first-come, first-served basis. Food will be served. Talk-in on .25/

.85 and .52 simplex. For tickets or more information, send an SASE to WVARA Hamfest, PO Box 81, Terre Haute IN 47808.

ROME NY
JUN 2

The Rome Radio Club will hold its 33rd annual Ham Family Day on Sunday, June 2, 1985, at Becks Grove, Rome NY. There will be something of interest for everyone: games, contests, the largest flea market in the area, good food, and educational and scientific presentations. The day will be climaxed with a fine dinner and the presentation of our "Ham of the Year Award." For further information, contact the Rome Radio Club, Inc., PO Box 721, Rome NY 13440.

MANASSAS VA
JUN 2

The Ole Virginia Hams ARC, Inc., will sponsor the eleventh annual Manassas Hamfest on Sunday, June 2, 1985, at the Prince William County Fairgrounds on Route 234, one-half mile south of Manassas VA. Admission is $4.00 per person (under 12 free). No advance sales. General admission is at 8:00 am, 7:00 am for tailgate setup. Activities include tailgating, indoor commercial exhibits, breakfast and lunch menus on grounds, YL program, and CW proficiency awards. Talk-in on 146.37/.97 (Manassas repeater WA4FPM) and 146.52 simplex. For further information, contact Art Whittum W1CRO, General Chairman, Manassas Hamfest, c/o Ole Virginia Hams ARC, Inc., PO Box 1255, Manassas VA 22110; (703)-381-4819.

NIAGARA FALLS NY
JUN 5-8

The Antique Radio Club of America (ARCA) will hold its annual international convention on June 5-8, 1985, in Niagara Falls NY. This year's convention is sponsored by the Niagara Frontier Wireless Association of Buffalo NY. Features of the convention will include speakers, tours of radio collections, and tours of the Niagara area. The highlight of the convention will be a large flea market where radio collectors will swap and sell parts, tubes, and associated literature. There will also be an auction of radios and associated items. The Niagara Falls area provides many recreational opportunities for family members whose interests do not include old radios. For information on the convention and on ARCA membership, write to NFWA, PO Box 68, Central Park Station, Buffalo NY 14215.

FORT KNOX KY
JUN 7-9

The Armored Force Amateur Radio Nationwide Emergency Team (A FAR NET) will hold an Eyeball Bivouac on June 7-9, 1985, at Fort Knox KY, the US Army's Armor Center. The gathering place will be the Best Western Gold Vault Inn in Radcliff (just outside the Fort). Campers can use the Fort Knox Campground facilities at Camp Carlson. For further information on the Eyeball Bivouac, contact Carl Ouickmire WB4UBS, 8341 Cloverdale Drive, Columbia SC 29209. A FAR NET is a group of radio amateurs who at some period of their lives served in or were attached to an armored (tank) unit of the armed forces. Any amateur who has ever served with or been assigned to an armored unit of the US Armed Forces or its allies is eligible for membership. A family member holding an amateur license is eligible for an associate membership. For further information about A FAR NET or for membership information, send an SASE to Harry B. Thomsen W2PJH, 348 Jefferson Avenue, Apt. 15, Canandaigua NY 11424.

BOWLING GREEN KY
JUN 8

The Kentucky Colonels ARC will hold its annual hamfest on June 8, 1985, beginning at 8:00 am, at the Jaycee Pavilion (inside a/c) on the So. Kentucky Fairgrounds, off US 231 North, Bowling Green KY. Admission is $2.00 and tables are $2.00. Outside setup is free. Refreshments will be available. Talk-in on 146.85/.25. For more information, contact Ed Gann N4HID, 445 Elrod Road, Bowling Green KY 42101; (502)-843-6911.

COEUR D'ALENE ID
JUN 8

The Kootenai ARS will sponsor Hamfest 85 on Saturday, June 8, 1985, from 8:00 am to 4:00 pm, at the Kootenai County Fairgrounds, Coeur D'Alene ID. Admission and swap tables are free. Setup is at 7:30 am. Free parking and food are available. RVs are welcome. Exams will be given. Talk-in on 146.38/.98. For more information, contact Jim Monroe N7ESU, W. 2455 Hidden Valley Road, Rathdrum ID 83858; (208)-687-0136.

ICE HARBOR DAM
JUN 8

The Tri-City ARC will operate special-event station W7VPA on June 8, 1985, from 1700-2400 UTC, from the Ice Harbor Dam, the highest lift navigable locks in the US. W7VPA will operate on the low end of the 10-80-meter General phone bands. For a special QSL, send an SASE to W7VPA, PO Box 73, Richland WA 99352.

BSA 75TH
JUN 8-9

The Chicago Suburban Radio Association will operate special-event amateur-radio station N9BAT from Brookfield Zoo in celebration of the 75th anniversary of the Boy Scouts of America. The Zoo will be hosting Scout-O-Rama, sponsored by the West Suburban Council, with over 5000 Scouts participating on the beautiful 200 acres of the Zoo. Amateur-radio operation will be on June 8 and June 9, 1985, from 1500 UTC to 2300 UTC, using the phone frequencies of 7.250 MHz and 14.250 MHz. A special "Eagle" QSL card (see page 82) symbolizing the highest rank in Boy Scouts will be available to all stations that reply with their QSL card and a #10 business-size SASE to N9BAT Special Event, PO Box 88, Lyons IL 60534.

CATFISHPEDITION 86
JUN 8-9

The Manitoba DX Group will operate VE4CAT for Catfishpedition 85 on June 8 and June 9, 1985, in the northern part of Manitoba. Talk-in frequencies: phone 7.200 and 14.259 MHz; CW 7.100 and 14.075 MHz. Spcial-event OSL cards will be issued from the Manitoba DX Group, PO Box 28, Group 322, RR3, Winnipeg, Manitoba, Canada R3C 2E7.

ALEXANDRIA LA
JUN 8-9

The Central Louisiana ARC will sponsor a hamfest on June 8-9, 1985, at the Bolton Avenue Community Center, 315 Bolton Avenue, Alexandria LA. Admission is free and swap tables will be available. There will be VE exams. Talk-in on 147.93/.33 or 146.04/.64. For more information, write to CLARC, PO Box 7772, Alexandria LA 71308.

FT. OGLETHORPE GA
JUN 8-9

The John Ross Amateur Radio Club will hold its annual hamfest on June 8-9, 1985, at the Lakeview-Ft. Oglethorpe High School, Ft. Oglethorpe GA (on Highway 2A, Exit 141, 4 miles off of I-75). There will be indoor air-conditioned dealer spaces and indoor and outdoor flea-market spaces. Tables will be available. Free parking and food will be available. Talk-in on 145.35/down. For reservations or more information, contact JRARC, PO Box 853, Rossville GA 30741; (404)-861-5610.

WENATCHEE WA
JUN 8-9

The Apple City Amateur Radio Club will sponsor the Central Washington Hamfest on June 8th and 9th, 1985, at Rocky Reach Dam, 7 miles north of Wenatchee WA on Highway 97. Admission is $5.00 for amateurs, $1.00 for non-amateurs. Children under 12 are free. Free camping and trailer space with power will be provided at the park. Events will include equipment displays and a swap shop. A banquet will be held on Saturday at 6:30 pm at the Masonic Temple. Talk-in on 146.07/.67 or 146.49 simplex. For reservations or more information, contact Merton Hiatt KD7YR, 1002 North Surry Road, Wenatchee WA 98801.

GRANITE CITY IL
JUN 9

The Egyptian Radio Club will hold its annual hamfest on Sunday, June 9, 1985, from 8:00 am to 3:00 pm, at the Egyptian Radio Clubhouse and grounds, Granite City IL. (I-270 to Route 3 South, turn right at Chain of Rocks Road and follow the signs.) Tickets are $1.00 in advance, or $2.00 each or 3 tickets for $5.00 at the hamfest. Flea-market spaces available on a first-come, first-served basis with the first space free (approximately 10 feet). Additional spaces will be $5.00. There will be a food stand and plenty of cold soft drinks. Free parking and shaded rest area will be provided. Talk-in on 146.16/.76 or 146.52 simplex. For more information, please send an SASE to the Egyptian Radio Club, PO Box 562, Granite City IL 62040.

NEWINGTON CT
JUN 9

The Newington Amateur Radio League will hold a flea market on Sunday, June 9, 1985, from 9:00 am to 2:00 pm, at Newington High School, Willard Avenue, Route 173, Newington CT. Admission is $2.00, tables are $8.50 (after May 31, $10.00), and tailgating is $5.00 (WX permitting). Talk-in on 146.52 simplex or W1AW/R 145.45 and 224.840. For tables, contact Tim Namnoum KM1O, 55 Spruce Street, Newington CT 06111.

MELVILLE NY
JUN 9

The Long Island Mobile Amateur Radio Club (LIMARC) will sponsor the Long Island Hamfair on Sunday, June 9, 1985, from 9:00 am to 4:00 pm, at the Electricians Hall, 41 Pinelawn Road, Melville, Long Island NY. Admission is $3.00, $2.00 after 1:00 pm. A 4 × 6 table is available for

$10.00, or bring your own for $6.00. Table space is available only in advance from Hank Wener WB2ALW, 53 Sherrard Street, East Hills NY 11577-1712; (516)-484-4322 nights to 11:30 pm EST.

MUNCIE IN
JUN 9

The Muncie Area ARC will hold its annual hamfest on Sunday, June 9, 1985, from 8:00 am to 3:00 pm, at the Delaware County Fairgrounds, Muncie IN. Admission is $2.00 in advance and $3.00 at the door. Tables are $5.00 each. Overnight camping will be available for $5.00 per space (includes water, electricity, and a dump station). Food and free parking will be available. For more information, tickets, or tables, contact Charles Stanly WB9BSE, 3609 N. New York, Muncie IN 47304; (317)-282-9738.

WINFIELD PA
JUN 9

The Milton Amateur Radio Club will hold its 14th annual hamfest on Sunday, June 9, 1985, from 8:00 am to 5:00 pm, rain or shine, at the Winfield Fire Hall grounds, on Route 15 (south of Lewisburg PA, 8 miles south of Exit 31 off of I-80), Winfield PA. Admission is $3.00, and spouses and children will be admitted free. Features include a flea market, an auction, and a contest. Talk-in on 146.37/.97 and 146.025/.625. For more information, contact Jerry Williamson WA3SXQ, 10 Old Farm Lane, Milton PA 17847; (717)-742-3027.

AKRON OH
JUN 9

The Goodyear ARC will hold its 18th annual hamfest on June 9, 1985, from 7:00 am to 5:00 pm, at the Wingfoot Lake Park, near US 224 and SR 43, five miles east of Akron OH. Family admission is $3.00 in advance and $4.00 at the gate. Flea-market spaces are $2.00 and dealer spaces are $5.00 (inside shelter). Talk-in on .04/.64 (WA8UXP). For tickets or information, send an SASE to Don Rodgers WA8SXJ, 161 S. Hawkins Avenue, Akron OH 44313, or call (216)-864-3665.

WILLOW SPRINGS IL
JUN 9

The Six Meter Club of Chicago will hold its 28th annual hamfest on Sunday, June 9, 1985, beginning at 6:00 am, at Santa Fe Park, 91st Street and Wolf Road, Willow Springs IL (southwest of downtown Chicago). Admission is $2.00 in advance and $3.00 at the gate. Table space in the pavilion is $20.00 per space. For table reservations, contact John Trepina K9QYT, 5015 W. 31st Place, Cicero IL 60650. There will be refreshments and plenty of parking. Talk-in on 146.52 (K9ONA) and 146.37/.97 (K9ONA/R). For advance tickets, contact Val Hellwig K9ZWV, 3420 South 60th Court, Cicero IL 60650.

TECHNIQUES IN HIGH-SPEED PHOTOGRAPHY AND VIDEOGRAPHY
JUN 10-14

The Massachusetts Institute of Technology will offer a summer course on "Techniques in High-Speed Photography and Videography," on June 10-14, 1985. This photoinstrumentation program of complimentary lectures and laboratory experiences, under the direction of C. E. Miller and Dr. Harold E. Edgerton, is for scientists, engineers, and photographers who must gather data on rapidly moving subjects or events for study, analysis, and troubleshooting. All students will receive hands-on experience for two days in the MIT Stroboscopic Light Lab, and the program allows each student to tailor his work to best fit his background and needs. Questions relating to program content should be addressed to C. E. Miller, 4-405 MIT, Cambridge MA 02139; (617)-253-4629. For registration information, contact the Director of the Summer Session, E19-356 MIT, Cambridge MA 02139; (617)-253-2101.

SPIVEY'S CORNER NC
JUN 15

The Cape Fear Amateur Radio Society will operate a special-event station on Saturday, June 15, 1985, from the 17th annual National Hollerin' Contest in Spivey's Corner NC. The station will be operating under the club call, WB4YZF, from 8:00 am till 5:00 pm EST, on or near 7235 kHz. For a special certificate, send QSL and QSO information and $1.00 to Hollerin' WA4LZD, PO Box 332, Dunn NC 28334.

DUNELLEN NJ
JUN 15

The Raritan Valley Radio Club will hold its 14th annual hamfest on Saturday, June 15, 1985, beginning at 8:30 am, at Columbia Park, Dunellen NJ. Sellers spots are $5.00; no tables are supplied. Lookers are $2.00 donation per person. Food and drink will be available at the refreshment stand. Talk-in on the club repeater, W2QW/R, 146.025/.625 and 146.52 simplex. Advance tickets may be purchased from any club member. Further information may be obtained from any club member or by calling Jack W2IWK at (201)-756-2546, or Ted WB2TKU at (201)-725-3481, from 10:00 am to 10:00 pm.

TWIN FALLS ID
JUN 15

The Magic Valley Chapter of the Idaho Society of Radio Amateurs will hold a swap meet on Saturday, June 15, 1985, from 9:00 am to 5:00 pm, indoors, at the Moose Lodge, 835 Falls Avenue, Twin Falls ID. Admission is free. Swap tables are $2.00. Exams will be given and ARRL representatives will be present. Talk-in on .16/.76. For further information, write to PO Box 294, Twin Falls ID 83303.

COBB ISLAND MD
JUN 15-16

The Bowie ARC of Maryland will operate N3GR/3 from Cobb Island MD, where Fessenden and Very sent and received intelligible speech by electromagnetic waves in December, 1900. Operation will start at 1400 UTC on June 15, 1985, and will end at 1400 UTC on June 16, 1985. Phone and CW operation will be in the General segments of 80 through 15, as propagation permits. CW: 30 kHz up from the bottom and the Novice portions. Continuous operation on 7.250 MHz. Certificate for SASE to confirm contact with N3GR/3 during this annual Bowie ARC expedition. For further information, contact Oliver B. Martin, Jr. WB3BVL, 3708 Irongate Lane, Bowie MD 20715.

ERLANGER KY
JUN 15-16

The Northern Kentucky Amateur Radio Club will sponsor Hamorama '85 on June 15th and 16th, 1965, beginning at 8:00 am both days, at Best Western Vegas Convention Center, I-75 to Exit 184B (Route 236), Erlanger KY (eight miles south of Cincinnati OH). Admission for both days is $5.00 per person, or the entire family for $8.00. Children under age 16 are free. Flea-market tables are $5.00 each for the entire weekend. The hamfest will be completely indoors, air conditioned, and free parking will be available. Major vendor setup is Friday evening, June 14th, after 8:00 pm. Flea-market setup is after 6:00 am both Saturday and Sunday. Food will be available. Talk-in on 147.86/.26 or 147.975/.375. For additional information, contact John A. Thernes WM4T, 60 Locust Avenue, Covington KY 41017; (513)-397-7425 days and (606)-331-0331 evenings.

SANTA MARIA CA
JUN 16

The Satellite Amateur Radio Club will hold its annual swapfest and Santa Maria-style barbecue at the Union Oil Picnic Grounds just south of Santa Maria CA, beginning at 9:00 am, on Father's Day, Sunday, June 16, 1985. Tickets for adults are $7.95, children 6-12 are $3.50, and children under 6 are free. Swap spaces (approximately 2' × 6') are each $3.50. A barbecue will be served at 1:00 pm. For further information, to order tickets, or to reserve a swap table, please write to Satellite Amateur Radio Club Swapfest, PO Box 1753, Santa Maria CA 93456.

CROWN POINT IN
JUN 16

The Lake County Amateur Radio Club will sponsor its 13th annual Father's Day Hamfest on Sunday, June 16, 1985, at the Lake County Fairgrounds industrial Building, Crown Point IN, which is located just inside the east gate. General admission is $2.50, with no advance sales. Free parking and tables will be available. Set up at 6:00 am. Hours are from 8:00 am to 2:00 pm. Features include MARS, ARRL/ARES tables, and computer demonstrations. Refreshments will be available. Overnight accommodations are close by. Talk-in on the Lake County ARC repeater, 147.84/.24, or .52 simplex. For more information, write Gene Hunkins KC9LH, PO Box 1909, Gary IN 46409, or call (312)-821-3210 (days) or (219)-937-9652 (evenings).

GLENDIVE MT
JUN 16

The LYARS of eastern Montana will hold its annual Father's Day picnic on June 16, 1985, at the National Guard Armory at the fairgrounds in Glendive MT. Registration is at 8:00 am and a potluck will be held at 1:00 pm. Licensing exams are tentative, pending interest. Camping hookups are available. For more information, contact Dave Brueni KC7AA, 215 3rd St. H.P., Glendive MT 59330.

FREDERICK MD
JUN 16

The Frederick Amateur Radio Club will hold its annual hamfest on June 16, 1985, from 8:00 am to 4:00 pm, at the Frederick Fairgrounds, Frederick MD. Admission is $3.00—YLs and children are free. Tables are $10.00 for the first one and $5.00 for each additional table. There is a $2.00 charge for tailgating. Setup begins at 8:00 pm on June 15, and overnight security will be provided. For more information, write Jim Kasunic KA3LPC, 9419 Highlander Ct., Walkersville MD 21793.

STEVENS POINT WI
JUN 16

The Central Wisconsin Radio Amateurs, Ltd., will hold its annual swapfest/family picnic on June 16, 1985, in Bukolt Park, Stephens Point WI. Features include dealers, food, and fellowship. Tables and tailgating areas will be available for $2.00. VE exams will be given. Talk-in on 146.07/.67 and .385/.985. For further information, contact Jim Benak KA9ACE, 1775 Strongs Avenue, Stevens Point WI 54481.

KLAMATH FALLS OR
JUN 20-22

The Northwest Division of the Mercury Amateur Radio Association will host the first annual MARA convention at Camp Easter Applegate, near Klamath Falls OR, on June 20-22, 1985. MARA will operate special-event station W7UFM from 2000 UTC, June 20, to 2400 UTC, June 22. Approximate frequencies will be 3.875, 7.275, 14.325, 21.425, and 28.525 MHz on SSB and 3.575, 7.115, 14.075, 21.115, and 26.115 MHz on CW. For a special commemorative QSL, send a large SASE to MARA, c/o Jack Jakoubek KD7EZ, 477 Deep Creek Road, Chehalis WA 98532.

YLRL CONVENTION
LAS VEGAS NV
JUN 20-23

The Young Ladies Relay League (YLRL) will hold its 10th international convention on June 20-23, 1985, at the Sahara Hotel, Las Vegas NV. Deluxe accommodations and RV parking are available for reasonable rates. Planned activities include a tour of Hoover Dam, a Lake Mead cruise, a desert tour, a stage show, a cocktail party, a luncheon buffet, an awards banquet, a DX YL show, slide shows, and business meetings. A convention station will be operating on 14,288 kHz and other frequencies. Registration forms can be found in the most recent issues of *Harmonics*, the YLRL's publication. For complete details and an information packet, send a business-size SASE (with 2 oz. of postage on it) to Jan Weaver N7YL, 2195 East Camero Avenue, Las Vegas NV 89123; (702)-361-3331.

NARF 25TH
JUN 22-29

The Nazarene Amateur Radio Fellowship (NARF) will operate special-event station WA9HPW/6 from June 22 to June 29, 1985, to commemorate NARF's 25th anniversary, during the General Assembly of the Church of the Nazarene in Anaheim CA. Frequencies will be 14.280, 14.305, and 21.385 during daylight hours. There will be some 40-meter activity. For a special QSL card, send an SASE to Robert Buck WB6UCO, 5162 W. Ave., L 12, Quartz Hill CA 93534.

YARMOUTH MA
JUN 23

The Yarmouth Repeater Association cordially invites you to their yearly Cape Cod amateur-radio and computer flea market and auction at the Mattacheese School, Yarmouth MA, on June 23, 1985. Gates are open from 9:00 am until 4:00 pm, with a giant auction from 1:00 pm to 3:00 pm. General admission is $1.00, with children under 12 free. Tailgaters are $2.00 per car and $8.00 per table. There will be excellent buys in used equipment, with plenty of refreshments, free parking, and good times. Talk-in on 147.645/.045. For more information, contact Bob Baker KQ1K, 2 High Grove Road, S. Yarmouth MA 02664.

KINGFIELD ME
JUN 27-30

The YL International Sideband System's annual convention will be held on June 27-30, 1985, at Sugarloaf/USA, located near Kingfield ME. Activities include the regular business meetings, a DX forum, a tour of the Rangeley Lake area, and a tour of Sugarloaf/USA with lunch at the top of the mountain. Accommodations at reasonable rates and RV parking are available. For complete details and a registration packet, please send a business-size SASE (37 cents) to Phyllis Davis KA1JC, PO Box 805, Presque Isle ME 04769.

MANCHESTER NH
JUN 29

The New Hampshire FM Association will sponsor New Hampshire's largest amateur-radio/electronic flea market on Saturday, June 29, 1985, beginning at 9:00 am, at the Manchester Municipal Airport. General admission is $1.00 per person; sellers are $5.00. Rain date is Sunday, June 30, 1985. Sellers should bring own table or tailgate. Commercial displays are welcome. Refreshments will be available. Talk-in on 146.52 FM. Send your pre-registration to 123 Woodlawn Circle, Portsmouth NH 03801. For further information, contact Doug Aiken K1WPM (803)-622-0831 or Pete Henriksen WA1RCF, 123 Woodlawn Circle, Portsmouth NH 03801; (603)-431-5432.

FORT LAURENS
JUN 29-30

The Tusco Amateur Radio Club (W8ZX) of Tuscarawas County OH will operate from 1400 UTC, June 29 until 2200 UTC, June 30, from Fort Laurens State Memorial near Bolivar OH, in conjunction with the Brigade of the American Revolution's reenactment of 18th-century military encampment, battle tactics, and field maneuvers. Ft. Laurens is the site of the only Revolutionary War fort built in Ohio. Operation will be on the lower 25 kHz of the General-class bands, 10 through 80 meters, SSB and CW, and Novice 7.130 and 21.150 ± 10 kHz. Special commemorative confirmation will be issued. Send a legal-size SASE (3 IRCs for DX) and QSO information to William K. MacNealy WD8LFM, RR#1 D37, Bolivar OH 44612.

BRESSLER PA
JUL 4

The Harrisburg RAC will sponsor its annual Firecracker Hamfest on July 4, 1985, at the Bressler Fire Company picnic grounds, near Exit 1 of I-283 at Route 441; follow the signs to Bressler. Three motels and several restaurants are located at this exit. Admission is $3.00, with XYLs and kids free. There is no charge for tailgating. VE exams will be given. There is parking for 1000 cars. For more information or for table reservations, contact Dave KC3MG, 131 Livingston Street, Swatara PA 17113; (717)-939-4957.

FORT LARAMIE WY
JUL 4-5

The High Plains ARC will operate K7YPT from 0000 UTC on July 4, 1985, through 0000 UTC on July 5, 1985, at historic Fort Laramie. Frequencies will be: phone—3.850, 7.250, 14.300, 21.360, and 28.550; CW—50 kHz up from the lower band edge. For a QSL, send a business-size SASE to K7YPT, PO Box T, Torrington WY 82240.

RAPID CITY SD
JUL 5-7

The Black Hills ARC will celebrate its 50th anniversary by sponsoring the 1985 ARRL Dakota Division Convention on July 5-7, 1985, at Howard Johnson's, Exit 59 off I-90, Rapid City SD. Features include exhibits, a flea market (free tables), forums, and alternate activities for the whole family. Pre-registration and a Saturday-night banquet ticket is $18.00. Pre-registration is $6.50 (pre-registration deadline is June 10). Registration after June 10 is $7.50. Additional banquet tickets are $12.50. Sunday buffet tickets are $6.75 ($3.75 for children 12 and under). Talk-in on .16/.76 and .34/.94. For further information, tune in the SD Evening Net (3870) or call (605)-787-5243 or (605)-343-6791. For pre-registration (make checks payable to Black Hills ARC), write to Gene F. Bauer KX0U, 713 Blaine Avenue, Rapid City SD 57701. Indicate if you desire information on motels or campgrounds.

ATLANTIC GA
JUL 6-7

The Atlantic Radio Club, Inc., will sponsor the Atlantic Hamfestival/ARRL Convention in the Georgia State World Congress Center on July 6 and 7, 1985. Everything will be indoors this year, with much improved facilities and access. For further information, contact Bill Schmidt KF4CQ, Secretary and Hamfestival Chairman, 219 Devonwood Drive, Atlanta GA 30328.

KINGSTON PA
JUL 7

The Murgas ARC (K3YTL) will sponsor the annual Wilkes-Barre Hamfest on Sunday, July 7, 1985, rain or shine, beginning at 8:00 am, at the 109th F. A. Armory, Market Street, Kingston PA (across the river from Wilkes-Barre). Admission is $3.00 and women and children under 16 are free. Tailgating spaces are $2.00 each. Tables and commercial power will be available. Setup begins at 6:00 am. Talk-in on 146.01/.61 and .52 simplex. For further information, contact the Hamfest Committee, PO Box 1094, Wilkes-Barre PA 18703; (717)-388-6863.

DOUGLAS WY
JUL 12-14

The Great Plains Repeater Association and the High Plains Amateur Radio Club will jointly sponsor the 1985 Wyoming Hamfest, to be held at the Wyoming State Fairgrounds in Douglas, Wyoming, on July 12-14, 1985. Items of interest include distributor displays, indoor flea market (tables available), license exams, seminars,

auction, banquet, breakfast, and much more! There will be ample RV parking with or without full hookups (plenty of motels). For full information or advanced registration, please send an SASE to Doug DesEnfants WA7WXQ, North Star Route, Torrington WY 82240.

DUTCHESS COUNTY NY
JUL 13

The Mount Beacon Hamfest will be held on July 13, 1985, from 8:00 am to 3:00 pm, at the Arlington Senior High School, Poughkeepsie/Lagrange, Dutchess County, NY. Admission is $2.00 and XYLs and kids are free. Tailgating spaces are $3.00 and tables are $4.00 (both include one free admission). The auction will take place at 2:00 pm. Free parking and food will be available. Talk-in on 146.37/.97 and 146.52. For more information, contact Julius Jones W2IHY, RR, Vanessa Lane, Staatsburg NY 12580; (914)-889-4933, or Steve Quigley KD2AK, Straub Drive, Pleasant Valley NY 12569; (914)-635-8539.

OAK CREEK WI
JUL 13

The South Milwaukee ARC will hold its annual swapfest on Saturday, July 13, 1985, from 7:00 am to 4:00 pm, at American Legion Post #434, 9327 South Shephard Avenue, Oak Creek WI. Admission is $3.00, which includes a "happy time" with free beverages. Parking, a picnic area, hot and cold sandwiches, and free overnight camping will be available. Talk-in on 146.94. For a map and more information, write to the South Milwaukee ARC, PO Box 102, South Milwaukee WI 53172-0102.

EAU CLAIRE WI
JUL 13

The Eau Claire Amateur Radio Club will hold its annual hamfest on Saturday, July 13, 1985, from 8:00 am to 4:00 pm in the 4-H building in Eau Claire WI. Tickets are $2.00 in advance and $3.00 at door. Free tables and coffee will be available. Talk-in on .31/.91 and .52 simplex. For information or tickets, send an SASE to Gene Lieberg KA9DWH, 2840 Saturn Ave., Eau Claire WI 54703.

SHEBOYGAN WI
JUL 13

The Sheboygan County ARC will sponsor the sixth annual Lakeshore Swapfest and Brat Fry on July 13, 1985, from 10:00 am to 4:00 pm, at the Wilson Town Hall, south of Sheboygan WI. Admission is $2.50 in advance and $3.00 at the door. Children under 12 (with family) are free. Tables are free. Camping is available at Terry Andre State Park. Food will be served. Talk-in on .66/.06 and .52. For more information, contact KR9S, 6400 Hawthorn Road, Sheboygan WI 53081; (414)-457-3366 after 5:00 pm CDT.

MAPLE RIDGE BC
JUL 13-14

The Maple Ridge Amateur Radio Club will sponsor the Maple Ridge Hamfest on July 13 and 14, 1985, at St. Patrick's Center, 22589 121st Ave., Maple Ridge, BC. Admission for hams is $5.00, for non-hams $2.00. Food, swap and shop, commercial displays, bunny hunt, ladies' and children's programs will be available (close to shopping and swimming). Camper space (no hookups) will be available. Talk-in on 3.758 MHz, 146.20/.80, and 146.34/.94. For more information or pre-registration (20% off gate admission), contact Maple Ridge ARC, Box 292, Maple Ridge, BC, Canada V2X 7G2.

MARION COUNTY IN
JUL 13-14

The Indianapolis Hamfest will be held on July 13 and 14, 1985, at the Marion County Fairgrounds, at the intersection of Interstates 74 and 465, Marion County IN. The $5.00 admission charge entitles you to free parking. Flea-market setup on Saturday is at 8:00 am. Commercial vendor setup on Saturday is at 10:00 am. The hamfest runs to 5:00 pm on Saturday. On Sunday, gates open at 6:00 am and the commercial building opens at 8:00 am. There will be free camper facilities and hookups available on the grounds. There are motels close by. There will be technical forums, the ARRL State Convention, and a banquet. For more information, contact the Indianapolis Hamfest, PO Box 11776, Indianapolis IN 46201.

SUMMER EXTRAVAGANZA
JUL 13-14

The Parks and Recreation Department of the City of Waynesboro VA and the Valley Amateur Radio Association will operate special-event station KI4BR in Ridgeview Park, in celebration of Summer Extravaganza. Hours will be from 1700 UTC on Saturday and Sunday, July 13 and 14, 1985. A First Edition Certificate will acknowledge QSO and receipt of QSL. Send an SASE to KI4BR, PO Box 565, Waynesboro VA 22980 for further information.

BATTLE CREEK MI
JUL 13-21

The Southern Michigan Amateur Radio Society will operate W8DF/8 during the Seventh World Hot-Air Balloon Championship, July 13-21, 1985, in Battle Creek, Michigan, at W. K. Kellogg Regional Airport. Operation will be on phone in the center portions of General-class 80-10-meter bands, and CW in the Novice bands. For a special QSL, send an SASE to PO Box 934, Battle Creek MI 49016.

LAPORTE IN
JUL 14

The LaPorte and Michigan City ARCs will sponsor their summer hamfest on Sunday, July 14, 1985, from 8:00 am to 2:00 pm, at the LaPorte County Fairgrounds, on State Road 2, west of Laporte IN. Admission is $3.00. Indoor tables are available by reservation for $.40/ft. Food and parking will be available. For table reservations or for more information, write to PO Box 30, LaPorte IN 46350.

LOUISVILLE OH
JUL 14

The Tusco ARC (W8ZX) and the Canton ARC (W8AL) will sponsor the 11th annual Hall of Fame Hamfest on July 14, 1985, at the Nimishillen Grange, 6461, Easton Street, Louisville OH (just east of Canton on US Route 62). Registration is $2.50 in advance and $3.00 at the gate. Tables are for rent on reserved basis only. Parking is $2.00 per vehicle. The deadline for table reservations is July 1st. Features include good food, a large flea market, dealers, forums, and more. Talk-in on 146.52/.52 and 147.71/.12 (W8ZX). For more information or reservations, contact Butch Lebold WA8SHP, 10877 Hazelview Ave., Alliance OH 44601; (216)-821-8794.

WHEELING WV
JUL 21

The Triple States Radio Amateur Club will hold its 7th annual Wheeling WV Hamfest and Computer Fair on Sunday, July 21, 1985, from 9:00 am to 4:00 pm, at Wheeling Park, Wheeling WV. Admission is $3.00. Children under 12 are free. Dealers are welcome. Everything is under one roof, and tables will be available. There will be 5 acres of flea market, free parking, and refreshments. Talk-in on 146.31/.91 or 147.75/.15. For further information or a map, contact Jay Paulovicks KD8GL, RD 3 Box 238, Wheeling WV 26003; (304)-232-6796, or TSRAC, Box 240, RD 1, Adena OH 43901; (614)-546-3930.

MOSCOW BLOWOUT
JUL 27-28

The Wichita Amateur Radio Club is sponsoring a Moscow Blowout at Moscow KS on July 27 and 28, 1985. The callsign will be W0SOE. The frequencies will be 5 to 10 kHz from the bottom edge of the General phone bands. QSL will be via W0SOE. There will be a mini-DXpedition to give everyone a chance to work Moscow.

WEST FRIENDSHIP MD
JUL 28

The Baltimore Radio Amateur Television Society (BRATS) will sponsor the Maryland Hamfest and Computerfest on Sunday, July 28, 1985, at the Howard County Fairgrounds, Route 144 at Route 32, adjacent to I-70, West Friendship MD. The facilities are accessible to the handicapped. Admission is $4.00. Tables along a wall with access to ac power are $20.00 each, or 4 for $75.00. Tables in the center of the floor are $10.00 each, with special rates for booths of 12 or 16 tables. Tailgating is $3.00 per space. Dealer setup will begin at 2:00 pm on Saturday, July 27 (overnight security will be provided). Free VE examinations will be given and no advanced registration is required. Refreshments will be available. Talk-in on 146.16/.76, 147.63/.03, and 146.52. For further information or for table reservations, contact Mayer Zimmerman W3GXK, BRATS, PO Box 5915, Baltimore MD 21208.

WIA 75TH ANNIVERSARY

The Wireless Institute of Australia, the world's first radio society, will celebrate its 75th anniversary during 1985. The WIA 75 Award will be available during the period from March 1, 1985, to December 31, 1985. To qualify, amateurs (and SWLs) need to contact (log) 75 members of the WIA. A contact will be valid only if the WIA member's individual membership number is logged. No more than 30 WIA members may be logged in any one callsign area. Send a log extract of the 75 members contacted and $2.00 (Australian) to WIA 75 Award Manager, Wireless Institute of Australia, 412 Brunswick Street, Fitzroy 3065, Victoria, Australia.

SATELLITES

USING THE AO-10 APOGEE PREDICTIONS

Apogee predictions for the month of June are provided for three sections of the United States: Washington DC at 39N 77W, Kansas at 39N 95W, and California at 38N 122W. Times are in UTC and apogee in this case is mean anomaly 128 rounded to the nearest whole hour. Use the chart as a guide in aiming your antenna, then fine-tune the azimuth and elevation values to peak the satellite's beacon signal. If you require more accurate orbital predictions, contact AMSAT at PO Box 27, Washington DC 20044.

AMSAT-OSCAR 10 APOGEE PREDICTIONS
JUNE 1985

			WASH		KANSAS		CALIF	
ORBIT	DAY	TIME	AZ	EL	AZ	EL	AZ	EL
1809	1	0600	108	0				
1810	1	1700					242	15
1812	2	1700					235	16
1814	3	1600			248	5	226	24
1816	4	1500	253	1	240	14	215	32
1818	5	1500	248	3	234	15	208	31
1820	6	1400	240	12	225	24	194	36
1822	7	1300	232	20	213	31	178	38
1824	8	1300	225	21	206	30	172	35
1826	9	1200	214	28	192	34	157	33
1828	10	1100	201	34	177	36	143	29
1830	11	1100	194	32	171	33	139	24
1832	12	1000	179	35	156	31	128	18
1834	13	0900	164	34	143	28	118	11
1836	14	0800	150	32	131	22	109	4
1838	15	0800	145	27	128	17		
1840	16	0700	133	22	118	10		
1842	17	0600	123	15	109	2		
1844	18	0600	121	10				
1845	18	1700					251	2
1846	19	0500	112	2				
1847	19	1700					246	4
1849	20	1600					238	13
1851	21	1500			250	2	230	21
1853	22	1500			245	4	223	22
1855	23	1400	250	0	237	12	212	29
1857	24	1300	243	8	228	21	199	34
1859	25	1300	237	10	222	21	192	32
1861	26	1200	228	18	211	28	177	34
1863	27	1100	218	26	198	33	162	34
1865	28	1100	211	25	190	31	157	29
1867	29	1000	199	31	176	33	144	26
1869	30	0900	185	34	162	32	132	20

FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

THE ENVELOPES, PLEASE

This year the Fun! Poll celebrates its fifth anniversary. Five years of opening envelopes, entering data into micros, tallying results, and reading comments. It's been a gas, to use the vernacular, and we hope to keep doing it for many years to come.

Response levels were up a bit this year. In 1984, 987 readers answered the poll. This year, 1023 of you mailed or electronically transmitted your responses to Fun! HQ. That's an encouraging sign, showing our hobby still has a lot of fight left in it. And a lot of Fun!, too, we hope.

Here's what you had to say:

ELEMENT 1 BACKGROUND

1) Sex:
A) Male—96%
B) Female—4%

As usual.

2) Age:
A) 15 or below—5%
B) 16-21—8%
C) 22-39—25%
D) 40-59—34%
E) 60 or above—28%

Pass out the Geritol.

3) License class:
A) Novice—10%
B) Technician—11%
C) General—27%
D) Advanced—40%
E) Extra—12%

The poll, over the years, shows a gradual flow of hams over to the higher license classes. A lack of newcomers to the hobby?

4) Number of years licensed:
A) 1 year or less—4%
B) 1-5 years—25%
C) 6-10 years—17%
D) 11-20 years—38%
E) 21 years and up—18%

Ditto.

5) Do you have a new (post-March '78) call?
A) Yes—58%
B) No—42%

The WAs, WBs, Ks, and Ws are swiftly fading into little more than a fond memory.

8) How many hours a week do you devote to amateur radio?
A) 0-1 hour—15%
B) 2-5 hours —34%
C) 6-10 hours—32%
D) 11-20 hours—15%
E) 21 hours or more—4%

About the same as last year.

7) Which HF band do you use most?
A) 80-75 meters—14%
B) 40 meters—26%
C) 20 meters—27%
D) 15 and/or 10 meters—22%
E) Don't operate HF—11%

Not much change here, either.

8) Which VHF/UHF band do you use most?
A) 6 meters—0%
B) 2 meters—75%
C) 220 MHz—8%
D) 420 MHz and/or up—4%
E) Don't operate VHF/UHF—13%

Nor here.

9) Which mode do you use most?
A) SSB—41%
B) CW—23%
C) FM—31%
D) RTTY—4%
E) Other—1%

Nor here.

10) How much money have you spent on amateur radio within the past year? (Include QSL expenses, magazine subscriptions, club dues, and other incidental expenses.)
A) 0-$250—41%
B) $251-$500—38%
C) $501-$1000—15%
D) $1001-$2500—4%
E) $2501 and up—2%

A bit better than last year, but still reminiscent of 1933.

ELEMENT 2 SOCIAL CHARACTERISTICS

11) On the whole, hams are:
A) too young—7%
B) too old—25%
C) just the right age—68%

Perhaps.

12) Do you wear a pocket-saver?
A) Yes—4%
B) No—96%

Another great ham tradition bites the dust! Don't blame me for all of those torn and dirty shirt pockets.

13) Politically, how would you define yourself?
A) Conservative—59%
B) Middle-of-the-road—39%
C) Liberal—2%

Mondale for ARRL President! Why not? His running mate was Mr. Fun!'s congresswoman.

14) Should we get rid of the ARRL?
A) Yes—48%
B) No—52%

A tie?

15) How old were you when you first became a ham?
A) 15 or below—10%
B) 16-21—57%
C) 22-39—21%
D) 40-59—8%
E) 60 or above—4%

No significant change from last year.

16) Should the FCC increase the speeds on amateur CW examinations?
A) Yes—19%
B) No—81%

Guess not.

17) Do you own a home computer?
A) Yes—61%
B) No—39%

Each year, more and more micro-equipped hams.

18) If you answered "yes" to question 17, which brand?
A) Apple—19%
B) IBM—8%
C) Radio Shack—28%
D) Commodore—36%
E) Other—9%

Many respondents noted more than one computer.

19) Do you think that home computing is siphoning people (including youngsters) away from amateur radio?
A) Yes—64%
B) No—36%

Obviously.

20) Do you think the volunteer exam system has increased cheating?
A) Yes—31%
B) No—69%

Last year, you were more pessimistic.

21) Do business interests deserve some of our virtually abandoned bands?
A) Yes—30%
B) No—70%

Shall we gift-wrap them?

22) Should ham licenses have a minimum age requirement?
A) Yes—47%
B) No—53%

A minimum IQ requirement?

23) Should ham licenses have a maximum age requirement?
A) Yes—11%
B) No—89%

Whatsamatter, you can't take a joke?

24) Should hams be subject to periodic retesting?
A) Yes—7%
B) No—93%

Over our dead ham bands!

ELEMENT 3 OPERATING HABITS

25) If the users were restricted to data communications only (no phone or CW operation), would you be in favor of a no-code 220-MHz Digital-class license?
A) Yes—54%
B) No—46%

When compared to last year's response, our attitude on this question is liberalizing.

26) Would you be in favor of a no-code 220-MHz Digital-class ticket if it permitted phone operation in addition to data transmission?
A) Yes—22%
B) No—78%

Here, too.

27) Have you ever used a personal computer in connection with your amateur-radio activities?
A) Yes—72%
B) No—28%

Up 2 percent from last year.

28) Is it time to completely deregulate amateur radio by having the FCC turn over all responsibility for ham operation to the amateur community?
A) Yes—57%
B) No—43%

No significant change from last year.

29) What do you think of people who view pay television services with MDS converters and satellite dishes that are not approved by broadcasters?
A) They're skunks—33%
B) They're within their rights—67%

Happy viewing.

30) Should we get rid of, or reduce in size, the CW subbands?
A) Yes—69%
B) No—31%

Up 8 percent from last year. The tide may be turning.

31) Do you think DX nets have a place in ham radio?
A) Yes—30%
B) No—70%

We got some really nasty comments on this one.

32) Do you think nets in general have a place in ham radio?
A) Yes—65%
B) No—35%

But no DX nets?

33) The next time a ham operates from space, which band should he/she use?
A) 2 meters—12%
B) 220 MHz—4%
C) 450 MHz—37%
D) An even higher band—17%
E) Shouldn't bother to operate—30%

Says a lot, doesn't it?

34) If, while tuning across a band, you heard a net called "Jammers International" in progress, would you:
A) Jam it—3%
B) Ignore it—15%
C) Complain to the FCC or some other organization—60%
D) Listen—22%
E) Join it—0%

Tell it to the ARRL.

35) If required, could you solidly copy CW at the speed at which you were licensed?
A) Yes—62%
B) No—38%

We believe you.

36) If required, could you pass the FCC theory test for your license class.
A) Yes—67%
B) No—33%

Would you lie to us? Nah.

37) Have you ever purposely operated in an amateur subband you weren't licensed to use?
A) Yes—4%
B) No—96%

Accidentally, maybe?

38) Are you fluent in any computer language?
A) Yes—35%
B) No—65%

Digitalk.

39) If you answered "yes" to question 38, which language?
A) Basic—81%
B) Pascal—9%
C) Assembler—4%
D) Machine—0%
E) Other—6%

Basic wins, hands down.

40) Do you feel yourself competent to write a short Basic program?
A) Yes—34%
B) No—66%

Good for you.

41) Do you feel yourself competent to replace the finals in a transistor-type rig?
A) Yes—70%
B) No—30%

Down a bit from last year.

42) Do you solder together your own coax connectors?
A) Yes—97%
B) No—3%

Thank goodness. All is not lost.

43) Is your antenna system mounted on your house or on a tower?
A) House—92%
B) Tower—8%

Or flat on the ground, like mine was after the last windstorm.

44) Have you ever designed your own antenna?
A) Yes—2%
B) No—98%

Not even a dipole?

45) What do you think of contesting?
A) Great—8%
B) Good—26%
C) Okay—13%
D) Don't like it—20%
E) Despise it—33%

No significant change here.

46) What do you think of DXing?
A) Great—30%
B) Good—29%
C) Okay—14%
D) Don't like it—13%
E) Despise it—14%

No change here, either.

47) What do you think of repeaters?
A) Great—41%
B) Good—9%
C) Okay—33%
D) Don't like them—15%

E) Despise them—2%

Nor here.

48) What do you think of traffic handling?

A) Great—6%
B) Good—30%
C) Okay—30%
D) Don't like it—8%
E) Despise it—26%

Nor here (yawn).

49) If you heard an emergency net in progress, would you immediately join in and offer your services?

A) Yes—59%
B) No—41%

I say, stay away until you're called for.

50) Have you ever secretly hoped for a minor disaster to strike your community just so you could demonstrate your radio skills?

A) Yes—18%
B) No—82%

Not even a little?

SELECTED COMMENTS

Although I'm an avid CW nut and home-brew artist, I think that—if we hope to keep our great hobby alive and well—we must admit (open the door) to our video-game generation with a no-code, restricted license! These younger hams (who hate code) aren't bad—just state-of-the-art!—**KE5DQ**

Good show! As a professional marketer, I believe in surveys. I also hope this helps direct the future of our hobby!—**K0GND**

My high school ham club has virtually died since 1978. Kids would rather stay after school to play games on computers than study for ham licenses.—**W9MP**

HAM HELP

Wanted: A "south-center" scale for the CD-44 Ham II rotor indicator. I will answer all responses.

B. J. Wenner VE6WN
Box 66,
Ralston, Alberta
Canada T0J 2N0

I would like to obtain a schematic and any other information about the National 190 communications receiver. I will pay all copying and postage costs.

Allen Bethel KA8FYN
209 Raindrop Lane
Hendersonville TN 37075

I need an instruction manual or a schematic diagram for an Eico model 717 electronic keyer. I will pay the cost of postage and duplicating.

Ed Cartotto W6ZZN
665 Avenida Loma Portal
Newbury Park CA 91320

I am looking for a schematic diagram and/or manual for the Hammarlund HX-Fifty.

Manuel Varela Cetina XE3EA
Apartado 132
Merida, Yuc.
Mexico

Help! I need manuals or information on a Navy OS/34-USM/32 scope, a Mite TT299B/UG teleprinter, and a Collins SSB book. Please write before sending material. Costs refunded.

M. Crestohl VE2FW
Box 642
Montreal, Quebec
Canada H3Z 2Y7

I need the instruction manual and tuning information for the 3-element monobander for 20 meters by TELREX. I bought it secondhand and all the manuals were lost. I will very gladly pay all costs involved (copying and postage charges), even air mail.

Michel Basquin H. CE3DPD
PO Box 9, STGO. 10, Las Condas
Santiago, Chile

I would like to borrow or buy a copy of the instruction manual for an Azden PCS-2800 transceiver. I will pay the cost of copying and postage.

John W. Sherman W6KAS
5301 Demaret #11
Bakersfield CA 93309

I need schematics for a National NC-270 receiver, a Hallicrafters SX-140 receiver, and an HT-40 transmitter. I will gladly pay all costs.

Gene Ray WD4GUA
Route 1, Box 64A
Milner GA 30257

I'm looking for a RTTY/CW interface for the Timex/Sinclair 2068 Color Computer, and any other ham-related software for this machine.

Scott Harvey
N. 5011 Idaho Rd.
Newman Lake WA 99025

I am in urgent need of a schematic circuit diagram or any other service information for an Intertec SuperBrain QD computer terminal. The manufacturer can no longer supply these items. Please advise of costs involved. Photocopies are OK, or I can copy and return the originals by insured mail.

William L. Hoy
514 Price Street
Charleston WV 25302

Help! I am in desperate need of the schematic, manual, or any information on a Browning model ON-5A oscillosynchroscope (oscilloscope). I will gladly bear any cost incurred.

Rick C. Wilson
604 S. Germantown Road
Chattanooga TN 37411

Please help me locate antenna relay number 62-913 for a 1965 Drake TR4. It's not available locally or through the factory.

John Shishkoff K5BCU
6932 Hemlock St.
Houston TX 77087

NEW PRODUCTS

ICOM IC-735

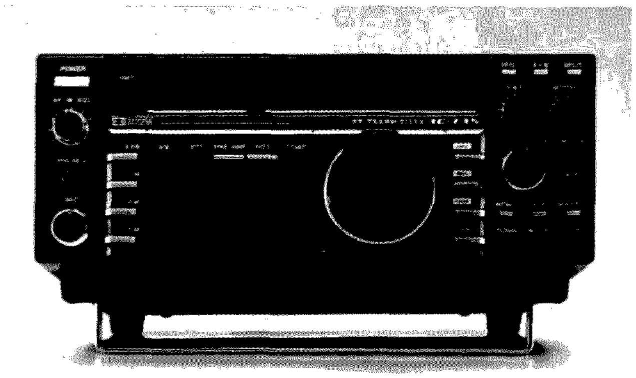
ICOM announces the IC-735 ultra-compact all-ham-band HF transceiver and general-coverage receiver. Measuring only 3.7 inches high by 9.5 inches wide by 9 inches deep, the IC-735 is well suited for mobile, marine, or base-station operation.

The IC-735 features a large LCD readout and conveniently located controls which allow simple operation, even in a mobile environment. VOX controls, mike gain, and other seldom-changed controls are kept out of sight behind a hatch on the front panel of the radio, but are immediately accessible.

Standard features include: built-in FM operation, a 500-Hz CW filter, an electronic CW keyer, the HM-12 scanning microphone, 12 tunable memories with lithium memory backup, automatic SSB selection by hand, 12-V operation, continuously-adjustable output power (up to 100 Watts), and a 100% duty cycle.

A new line of accessories will also be available, including the AT-120 automatic programmable antenna tuner and the PS-55 power supply. The IC-735 is also compatible with most of ICOM's existing line of HF accessories.

For complete details, contact *ICOM America, Inc., 2380 116th Avenue NE, Bellevue WA 98004.*



The ICOM IC-735.

SMARTWORK PC-BOARD DESIGN SOFTWARE FOR THE IBM PC/AT

Wintek's smARTWORK software, a low-cost tool for creating printed-circuit-board artwork, is now available in a version which runs on the IBM PC/AT. The program allows quick correction and revision of artwork, increasing design productivity and decreasing product-development time. Elementary functions are easy to learn, while advanced techniques allow sophisticated layouts.

Using smARTWORK, the designer can produce single-sided or double-sided printed circuit boards up to 10 by 16 inches. The layout can be displayed in either color or black and white. Prototype-quality 2X plots can be made on a dot-matrix printer, and production-quality artwork can be produced with a pen-and-ink plotter.

For complete information, contact *Wintek Corporation, 1801 South Street, Lafayette IN 47904; (317)-742-8428.*

PC-board development software from Wintek.

HELP FOR DOS USERS

Help Technologies has announced HelpDOS, a help system for PC-DOS and MS-DOS. HelpDOS makes it easy to find out what DOS can do and how to use it. the menu-driven program provides on-screen reference information and examples for DOS commands, special keyboard keys, and batch subcommands. A technical dictionary explains the often confusing terms that one encounters with DOS and personal computers.

A unique "Hints" feature helps you find the right DOS facility for your task. For example, when you select the hint "Print," HelpDOS gives you a menu of the ways you can print using DOS. You can then select from this menu the help information that is most appropriate for your current need.

New help files and menus may be added to HelpDOS, allowing it to be used as a general "help tool." This provides a consistent way to organize and view on-line documentation for special programs, procedures, and batch files. Any text file stored in standard DOS (ASCII) format can be added to HelpDOS.

Available now, HelpDOS runs on the IBM PC, XT, AT, PCjr, and compatibles running PC-DOS or MS-DOS 2.0 or greater. Hardware requirements are at least one double-sided diskette drive and 128K RAM.

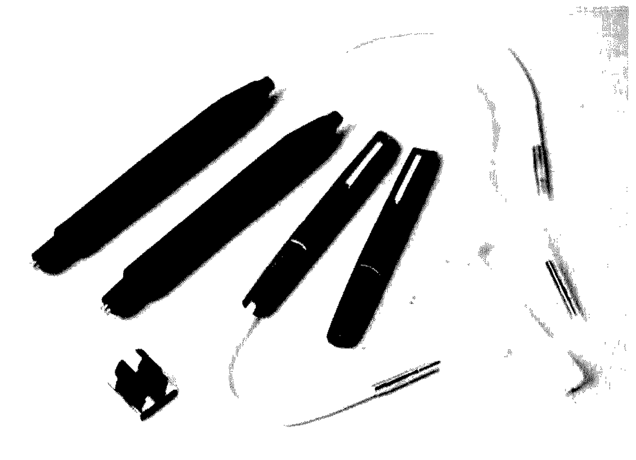
For additional information, contact *Help Technologies, PO Box 50834, Palo Alto CA 94303.*

FLEXIBLE ILLUMINATOR

SMMI Products has developed a new, high-intensity flexible lighting instrument. The special #1201 miniature lamp attached to the end of a nearly indestructible coaxial cable delivers a full 450-lumen brilliance to any area not accessible by normal lighting. The flexible characteristics of this special cable allow any configuration necessary to get the light where you need it.

The Flexible Illuminator™ has several adapters to help the technician. An illuminated pick-up magnet easily slips over the bulb to help locate and retrieve nuts and bolts. An extension handle to increase the pick-up length and a clip-on magnet to give hands-free lighting for hard-to-see areas are also available.

For complete information, contact *SMMI Products, 4231 112th Terrace North, Clearwater FL 33520.*

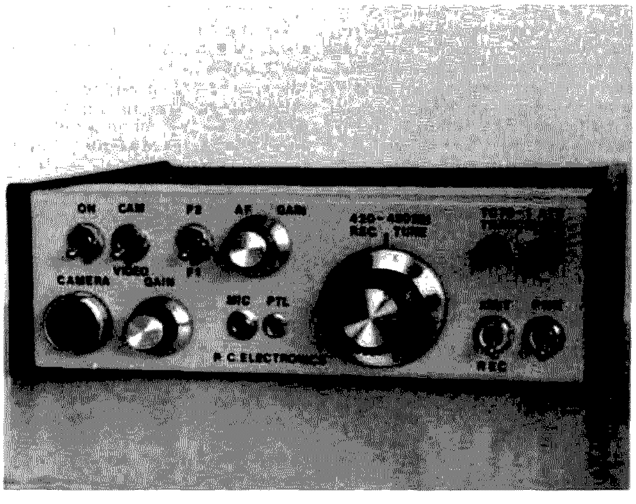


SMMI Products' Flexible Illuminator system.

TC70-1 ATV TRANSCEIVER

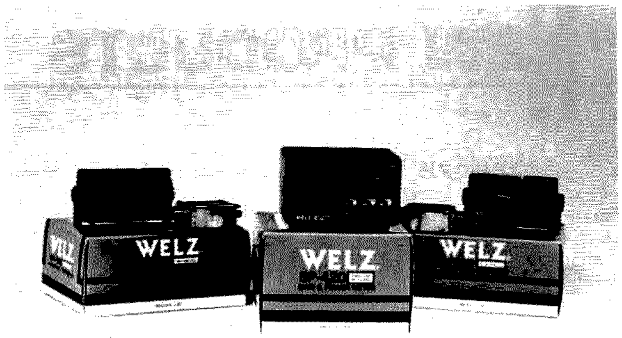
P. C. Electronics has introduced a small 1-Watt 70-cm ATV transceiver. The TC70-1 accepts standard composite-video input from any source. Video- and audio-input RCA jacks on the rear panel are provided for connection to black-and-white or color cameras, computers, VCRs, etc. A front-panel switch selects video and audio input from these jacks or from the 10-pin connector which is provided for direct connection to many of the popular color cameras made for portable VCRs.

Full-color live-action video and sound is transmitted with over 1 Watt PEP on one



ATV transceiver from P. C. Electronics.

Kantronics' new Packet Communicator.



Three swr meters by Welz.

of two selected crystal-controlled frequencies in the range 425 to 440 MHz. The line-of-sight snow-free radius with a TC70-1 and a KLM 440-27 antenna at each end is 15 miles. The unit is designed for portable use, but either a 20-Watt or 50-Watt video-compensated rf linear amplifier is available.

The receive downconverter uses a MRF986 dual-gate GaAsFET in both the rf preamp and mixer stages for high sensitivity and dynamic range. Front-panel tuning is variable over the whole 420-450-MHz band for receiving simplex and repeater ATV.

With the TC70-1, the only other items necessary to get on ATV is a good 70-cm antenna and low-loss coax, your TV set, and any device with a standard 1-V p-p composite-video output commonly found on black-and-white CCTV cameras, home-video color cameras and VCRs, computers, RTTY/video converters, etc. A Technician-class or higher amateur-radio license is required for operation and purchase from P. C. Electronics.

For more information and a complete catalog of ATV equipment, antennas, cameras, modules, and accessories, write or call *P. C. Electronics, 2522 Paxson Lane, Arcadia CA 91006;* (818)-447-4585.

KANTRONICS PACKET COMMUNICATOR

Kantronics has announced the Kantronics Packet Communicator, a new product for amateurs using computers in the shack.

With the ARRL adoption of the AX.25 protocol as the amateur standard, packet radio has become a viable form of data exchange. Thousands of amateurs have proven the new mode reliable using a hardware and software program devised by the Tucson Area Packet Radio (TAPR) group.

Kantronics has designed a new hardware format using an internal microprocessor to handle the protocol, and integrated circuits for signal processing. Data is transmitted between the Kantronics Packet Communicator and a computer using a serial RS-232 or TTL port. Baud rates of 300, 1200, and 9600 are supported. Any terminal or communications software program can be used to set up the computer to communicate with the Packet Communicator. The ability to exchange data with existing Packet Terminal Node Controllers has been achieved with the Packet Communicator by using the popular Tucson Area Packet Radio group software. Almost all of the commands and operation procedures used by the TAPR group are used with the Packet Communicator. Both the ARRL standard AX.25 and Vancouver protocols are incorporated in the unit.

An added feature of the Packet Communicator is the ability to select either Bell 103 or 202 tones for 300-baud operation. This will allow the operator to switch to the lower tone set, improving performance at slower speeds on the HF bands.

The unit is housed in an extruded aluminum case measuring 1.9" × 5.9" × 8". An external power supply and cables for connection to the transceiver and computer are included. The user must provide the RS-232 and microphone connectors. The Kantronics Packet Communicator is not available in kit form.

For more information, contact *Kantronics, 1202 E. 23rd St., Lawrence KS 66046.*

CUSHCRAFT CATALOG

Cushcraft has released their latest full-line amateur antenna and accessory catalog. The 16-page, two-color booklet contains complete specifications on antennas in the frequency range from 3 to 450 MHz. There are three new Boomer 2-meter antennas, a two-element 40-meter beam, Cushcraft/Signals VHF mobile antennas, and a through-the-wall lightning arrester. To receive your free copy, write *Cushcraft Ham Catalog, PO Box 4680, Manchester NH 03108.*

NEW HAMTRONICS DIGITAL FSK DATA MODULES

With packet radio and other forms of digital data communications becoming so popular, Hamtronics®, Inc., has announced two new modules to complement their line of VHF and UHF FM transmitters and receivers. The new modules provide for data interface with radio equipment using the popular "202" modem format (1200/2200-Hz tones) at data rates up to 1200 baud on ordinary NBFM channels. In addition to modulating and demodulating the data pulses, these modules provide transmitter keying and full handshaking facilities.

The MO-202 FSK Data Modulator is a PC-board module measuring 1-7/8 × 4 inches. It automatically keys the transmitter in response to a "request to send" input from the computer, and it provides a "clear to send" handshake 25 milliseconds later, after the transmitter and receiver have had time to respond. Relative levels of the 1200- and 2200-Hz space and mark tones are equalized to compensate for the EIA pre-emphasis in the transmitter.

The DE-202 FSK Data Demodulator is a PC-board module measuring only 1-1/2 × 4 inches. It can be used with any FM receiver or transceiver to detect FSK transmissions and automatically provide a "receive carrier detect" handshake to the computer when mark or space tones are present. A special frequency-compensation circuit levels the two tones coming from the receiver to allow for maximum weak-signal response.

Other features of the two modules include 12-V-dc power-supply inputs, operation with either RS-232 or TTL computer interfaces, and built-in LED test indicators for each function. The MO-202 can switch B+ at up to 600 mA for transmitter keying. Full instructions are included to allow interfacing with any type of radio equipment.

For more information on these and other Hamtronics products, such as transmitters, receivers, repeaters, converters, and preamps, write to *Hamtronics, Inc., 65-F Moul Road, Hilton NY 14468-9535.*

VSWR BRIDGES

Welz Corporation and their American distributor, Encomm, Inc., have announced the introduction of a new series of wattmeters and vswr bridges. Some models meaure peak and average power, while the mobile units also measure the automobile's operating voltage.

For more information on the new line of wattmeters, contact *Encomm, Inc., 2000 Ave. G Suite 800, Plano TX 75074.*

TRIPLETT MODEL 4700 MULTIMETER

Penril's Triplett Electrical Instrument Corporation has introduced the new Model 4700 digital multimeter. The unit uses a microprocessor controller to provide features such as true rms metering, a logic probe, an audible continuity test, dBm display of voltages, and the capability to store an input signal with an offset value. Each function has automatic polarity switching, overrange indication, overload protection, and quantitized feedback A/D conversion. The meter uses a 4-1/2-digit high-contrast LCD, operates on 4 AA batteries, and has recessed jacks for maximum safety.

For complete details, write *Triplett Electrical Instrument Corporation, One Triplett Drive, Bluffton OH 45817.*

REVIEW

AEA PKT-1 PACKET RADIO CONTROLLER

Every once in a while something comes along in this amateur-radio hobby of ours that is just plain neat! I imagine some of you felt that way about single sideband. For me it was the OSCAR satellites. To varying degrees I've been excited about radioteletype, television, meteor scatter, QRP operation, and most recently, computers. What I've just discovered combines the technology of quite a few of those specialized techniques.

It's very difficult for me to separate my enthusiasm for a new mode of communications from the product itself. Fortunately, both deserve high marks, so there shouldn't be any conflict.

Just when you thought you finally understood RTTY, inexpensive computers came along. They made it possible for almost all of us to enjoy reliable, inexpensive, and (most importantly) quiet teletype communication. As a youngster at home I had to turn down more than one Model 15 because they just made too much noise.

Just to keep you on your toes, ASCII transmissions were introduced, and oh yes, let's get everyone stirred up about AMTOR as well.

A few years ago several small groups of amateurs began experimenting with yet another way to transmit digital data. Borrowing heavily from land-line-based systems, *packet radio* was born. The end result is a real revolution in amateur message communications.

Packet radio doesn't really use any hot-off-the-presses technology. It does allow maximum application of the existing technology.

73 carried an excellent series of articles about packet radio which began in Sep-

tember of 1983. I won't reinvent the wheel here, but suffice it to say that packet radio allows the use of relatively high speed ASCII transmissions with two important additions:

Addressing and identification information allow individual transmissions to be identified and routed to the final destination. Secondly, a mathematically-computed "checksum" ensures error-free reception of messages. These two enhancements make packet radio well suited to long-haul message delivery.

So what do you need to try out this new mode? First, you should know that most activity at present is on the 2-meter band. Many experiments are being done with HF linking and extremely high speed transmission rates on UHF, where bandwidth is not as much of a problem. If you own a 2-meter FM rig, you are part of the way there.

In order to properly receive and transmit packet, you need a terminal node controller, or TNC. That's where the PKT-1 comes in.

Finally, you need some kind of ASCII terminal. Mechanical machines, electronic "dumb" terminals, or a personal computer are all usable. If you are so inclined, you can even use the VAX system at work. That would look interesting on a QSL card!

The TNC is a computer in itself. Two microprocessors are included. One formats the packets, and the other one takes care of all the timing.

The PKT-1 is electrically a TAPR, Tucson Amateur Packet Radio, packet board. Under special license, AEA is manufacturing the packet controller fully assembled and tested and with a few additional bells and whistles thrown in to boot.

TAPR sells both bare boards and kits. The PKT-1 is aimed at the amateur who is not necessarily adept at working on microelectronics but still wants to join in.

As with all AEA products, the craftsmanship on the PKT-1 is superb. I always feel like I'm looking at something that has been built for the space program when I look at their boards.

Operationally, the PKT-1 is pretty straightforward. Included is a 100+-page instruction manual. If you want to learn even more, the technical manual is available for an additional charge.

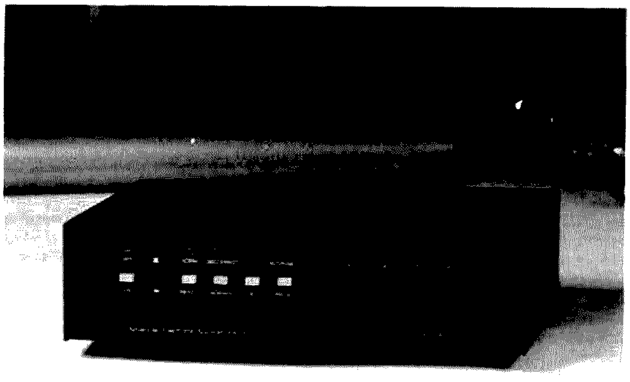
Setup is a breeze. Twelve-volt regulated dc is needed. That's one of the AEA enhancements. The PKT-1 is ready for mobile/portable packet operation, the TAPR board is not.

You'll need a connector to match either the microphone connector on your radio and the speaker jack, or one that matches your accessory plug on the rear of your radio.

Your terminal or computer must have a genuine RS-232 connection available. If you are a Commodore owner like myself, this will mean the construction or purchase of an interface to bring the Commodore TTL levels into line with the RS-232 standard. Incidentally, numerous official Commodore "VIC" RS-232 adapters have been closed out recently for $10.00 or so. The merchandisers don't seem to know that the adapter works just dandy on a C-64!

Once you are set with RS-232 levels, you'll need a cable with male DB-25 connectors on each end. Such cables are expensive when purchased ready-made. I built mine using wire from some scrap telephone multi-line cable. It took about an hour, but I saved about $25.00 and got the cable the length I wanted it.

Finally, if you are using a personal computer, you will need a terminal emulation program. The same program you use for regular modem communications will do quite nicely.



AEA's PKT-1 Packet Controller.

With everything connected, you are ready to go. The PKT-1 is very versatile and will adapt to almost any operating environment. When first trying the unit, you select the built-in ready-only memory. A set of default parameters is stored here. There is even an "auto speed" routine programmed that allows the PKT-1 to adjust to the terminal's speed. All you have to do is send a few "*" characters.

Once you are in communication with the PKT-1, you can adjust the terminal settings and other values to suit your station and needs. Something new to most of us, a nonvolatile random access memory (NOVRAM), allows you to store two sets of parameters of your own choosing. What makes the NOVRAM unique is that it requires no power backup.

Guess what? You get to learn a new set of commands! The program in the PKT-1 is so "soft" it will allow you all kinds of control over things. To access or check these items, you must input the proper mnemonic while in command mode. It's really not as hard as it sounds. BT, for example, is beacon text, B alone is beacon (timing), D means disconnect, C means connect, and so on.

Like any new language, it will take some time to learn. I assure you it will take a lot less time than learning any other computer language, though!

At this point, I was ready to fire away. Through some casual monitoring, I knew that local packet activity in my area took place on 147.555 MHz. In many areas of the country, however, activity is centered around 145 MHz, plus and minus a bit.

I also happened to know the callsigns for several of the packet stations in my area. Throwing caution to the wind, I typed: C WA9KRL. My radio sprang to life, lights flashed, a burst of packet sound came out of my speaker, and the screen flashed: ***Connected to WA9KRL***. So far, so good.

Unfortunately, that's about as far as I got until later in the day when everyone turned of their rigs and saw K9EI all over their screens.

Several options are available in the PKT-1 to allow for selective monitoring. You can choose to have all transmissions displayed, beacon messages only, or transmissions from a specific group of stations. Even with so much versatility available, it seems most stations in my area enjoy the "party line" aspects of monitoring all transmissions.

With some assistance, I learned of other stations active in my area and a wide-area packet repeater about 80 miles from me that provides coverage over a good portion of central Illinois. That's when things started getting interesting.

When connected to some stations, I found that both the receiving station and I were having difficulty receiving correct packets. With signals over S9, it didn't seem that the path was a contributing factor.

I noticed when monitoring my own signal on another radio that the first portion of my transmission seemed clipped off. Back to the manual and I discovered that I could set the amount of delay before I began actual transmissions. Problem number one had been solved.

The second problem was a bit more insidious. When connected to certain stations, or when repeating through these same stations, everything seemed to work well. Other stations, however, didn't seem to work well at all. I could repeat through one of the "good" stations, however, and everything was fine. I finally came to suspect my transmit tones.

I must explain that this particular PKT-1 has been jostled about a bit. It lived for a while at the famous W2NSD ham shack. After prying KW1O's fingers off of it long enough to get it in the mail, it was trucked across the country to me. It arrived while we were enjoying a balmy −20-degree day here in central Illinois.

All of this allowed me to check out the diagnostic and adjustment part of the PKT-1 program. Talk about space-age. I was led step by step through the necessary adjustments to bring my tones right back on the money. All it took was a small screwdriver. A bobby pin probably would have worked in a pinch.

With the adjustment made and the clock reading 2:00 am, I keyed up a path to a packet MSO about 85 miles east of me. Pretty impressive, eh? Get this: My path was 50 miles northeast, 30 miles due north, and 110 miles south-southeast! I traveled almost twice the actual distance to get there with two relays. . .and it worked. . .error free.

To give another practical example, my folks live about 180 miles to the northeast of me. Using three or four relays (depending on band conditions), I can connect to a fellow just two miles from them. It sure beats the mail.

Nothing special is required to turn your PKT-1 into a digital repeater. In fact, unless you tell it otherwise, every TNC is also a digipeater. Your station simply stores the received data in memory and then retransmits it intact to the addressee.

Something that had escaped me in all of the literature about packet radio is that all kinds of special features can be implemented with very little trouble. I mentioned an MSO earlier. The PKT-1 doesn't care what kind of terminal program it is connected to, so you can easily adapt a bulletin-board program for use on packet.

Somewhat less ambitious, but along the same lines, are packet answering machines. They aren't bulletin boards or MSOs in the usual sense. All you can do is store a message (or a program for that matter) for the owner of the station.

There is even a "transparent" mode which allows files to be transferred without respect to their particular configuration. This is true binary transfer and makes sending computer programs from one machine to another quite easy.

With this in mind, all kinds of connections could be made. You are limited only by your imagination and FCC regulations.

The only fault I have found in the packet system involves disconnecting. On several occasions I have been connected to a remote station and experienced a band fade. No number of retrys would get the disconnect order through. If the station is unattended, this leaves that terminal "busy" until the owner manually disconnects it, or until the connecting station reestablishes contact and then disconnects. A simple watchdog timer could cure this problem. Keep in mind that the "hung-up" station is not transmitting or otherwise causing any problems. It is simply marked busy and is unavailable to other users.

There are some limitations in the built-in modem itself. The TAPR-designed unit comes equipped with an XR-2206 and XR-2211 chip set to generate and demodulate the FSK tones. The receive chip works well when the signal-to-noise ratio is relatively high. It starts to suffer problems as the ratio decreases.

Improvements to the operation of the chip are accomplished by filtering the input. The PKT-1 allows for the critical components in this filter to be mounted on a standard DIP header, so experimentation can be done easily. This also allows for operation at shifts other than 1000 Hz. I found that a bit of time spent in simply adjusting the audio level to the PKT-1 resulted in a quite noticeable improvement in reception. Others with TAPR-type boards report that level adjustment is also critical and varies widely depending on the radio used. Provisions are also available for using an external modem. In any case, the limitations are not peculiar to the PKT-1, but rather are inherent in the integrated circuit being used.

I told you I'd get carried away. The PKT-1 is superb. Packet radio is one of amateur radio's most promising frontiers. The combination of the two is terrific fun. Congratulations, AEA, for making the technology available in prepackaged form. Kudos to TAPR for all of their hard work in designing the board and bringing this new communications mode to the amateur community.

For more information about the PKT-1, contact *AEA, PO Box C-2160, Lynnwood WA 98036; (206)-775-7373.*

Jim Grubbs
Springfield IL

KENWOOD TR-2600A

There's an old adage which says that "good things come in small packages," and in the hand-held transceiver market it is very true. Just look at what's available! There are rigs which fit in your shirt pocket, rigs which feature both sideband and FM operation, and compact rigs which have just about every feature you will find on a base or mobile transceiver.

Look at the Kenwood TR-2600A, for example. This microprocessor-controlled hand-held has some interesting features and capabilities. For instance, not only does this 1.2-pound rig transmit and receive through the entire two-meter range, but it also will transmit above and below to cover both MARS and CAP frequencies. It will transmit from 142 MHz to 148.995 MHz. Further, you can program this hand-held to cover the splits normally used by MARS or CAP and use any odd-split repeaters, using Memory 0.

All of this is pretty normal in today's hand-held rigs. The new Yaesu FT-209RH will do it, as will the ICOM-02AT. However, the TR-2600 has a couple of features which the others don't have. First, it will receive continuously from 140 MHz to 159.995 MHz with about the same sensitivity as it exhibits in the two-meter band. It won't transmit above and below the MARS or CAP areas, though.

And the Kenwood hand-held has DCS, or digital squelch, which works quite well. DCS is very much like selective-calling units which many amateurs have added to their base rigs. With the selective-calling circuitry, a receiver remains quiet until it hears a special code and then the squelch will open. DCS uses an ASCII burst "header" at the start of a transmission. Although it sounds like noise, what you are actually transmitting is a special code. If this code matches the code programmed into a second transceiver, the second transceiver will open and the receive circuitry will respond. If the second transceiver doesn't receive the special header, then it will remain quiet, as if nothing is going on. This system also allows you to program in your call so the second transceiver can see the station calling. It will appear on the Kenwood's LCD.

The TR-2600A is loaded with nice, user-oriented features. For example, all the major functions are programmable from the keypad, and the function switch which accesses them is also located on the pad. This means you can have direct access and implementation of such features as the offset, type of scan, type of scanning stop (tone or squelch), and memory. On some other hand-helds, you must hold down an awkwardly-placed function key to have access to these features.

Another nice feature is the ability to program in the offset, which is an improvement over the Kenwood TR-2500 (where you had to use a slide switch). The offset is retained in the memory of the TR-2600A, but you can easily change it with the function key and plus or minus keys. For nine of its ten memory channels, the TR-2600A assumes the standard 600-kHz offset.

Still another nice feature of this hand-held—and an improvement over the 2500—is the locking reverse switch. This allows you to check the input of a repeater to see if another station is within simplex range. On the 2500, the reverse switch didn't lock and you had to manually hold it for a long period of time.

When Kenwood upgraded its microprocessor-controlled hand-held from the 2500 to the 2600, they redesigned the unit. For instance, they moved the amp switch from the front panel to the right-hand side and the transmit-lock and keyboard-lock switches were moved to locations underneath the push-to-talk bar. Believe it or not, though, this makes these features more convenient for one-handed operation. The redesign also made room for a real, mini-sized S/rf meter, which also doubles as a battery condition indicator. It's a nice touch and enables you to check the received signal strength of any repeater or mobile station. It was placed on the top of this hand-held, evidently because Kenwood assumed most amateurs would be using this rig on their belts. Yaesu, on the other hand, has included its S/rf meter on the front panel, which does make it more convenient to use if the hand-held is laying on a car seat. Still, we can't quibble with either placement because either one has its advantages.

Like its predecessor, the TR-2500, the TR-2600A has low- and high-power settings. On low power, it puts out about 300 mW, while on high power it puts out about 2.5 Watts. These power levels are more than enough to work today's urban repeater systems, although they may not be high enough to work some repeaters in rural locations. For those repeaters, a small amplifier, using the TR-2600A as the exciter, should work quite nicely.

For those operators needing tone access, the TR-2600A is ready to accept a tone module, although you will have to order it as an option and install it. The tone switch is included on the top of the hand-held. This is unlike the 02AT, which has the tones built in. However, since most repeaters still are open access, the tone option remains just that, an option.

Looking at the specifications of the TR-2600A, you will find it is quite a capable unit. It only requires 8.4 V dc for operation, although it will accept 9 volts from manganese or alkaline batteries, which is a nice backup feature. Memory is retained with a lithium battery, which should be good for five years.

In operation, the TR-2600 uses about 35 mA with no input signal. It will pull as much as 800 mA in high-power transmit and as much as 400 mA with low power. Less than 1 uA is needed for the backup memory.

It is a double-conversion, superheterodyne unit. Its first i-f is the almost-standard 10.7 MHz and the second i-f is 455 kHz. It uses variable-reactance direct-shift modulation and its maximum frequency deviation is 5 kHz.

Our testing confirms that its published specifications are right on the money. Receive sensitivity is better than 1 uV for a signal-to-noise ratio of 30 dB and less than 0.2 uV for 12-dB Sinad. Selectivity is less than 24 kHz at 40 dB down and the passband width is more than 12 kHz at 6 dB down. Spurious response is better than 50 dB and squelch sensitivity is less than 0.25 uV. Audio output is more than 400 mW into an 8-Ohm load.

In operation, the 2600 is an excellent piece of equipment. It is easy to program and its scan modes are easy to implement. It also allows you to lock out memory channels during a scan. The priority feature is nice, especially if you like to monitor more than one frequency, because it quickly tells you if there is activity on the priority channel with a double beep.

The DCS is a nice feature, but it is more of a luxury than a necessity, unless your club or your friends plan a mass buy of these units. The reason is because there are few other Kenwoods out there with the DCS feature, and until they become widespread, there will be very little call for it. Still, it does work well, as tests with a neighboring station confirm. Not only does the squelch open when the second unit calls, but a small orange LED indicates you've had a call.

And speaking of LEDs, the Kenwood TR-2600 uses a multicolored LED to indicate both transmit and receive. It shows green for receive and red for transmit, which is another nice feature.

During testing through our local repeater and with other stations, we received praise for the audio quality of the rig and, at the same time, we can say that the receive audio quality is excellent. It is crisp and punchy. The signal-strength meter also is reasonably accurate.

We also found that on average a battery will last quite long while on receive, although continuous high-power transmission will quickly drain it. In fact, if you transmit at high power for as little as one minute in three, you will find the battery is worn down in about 1½ hours. Lower power should effectively double battery life. The normal battery is an 8.4-V-dc ni-cad. About the only quibble we found with this unit was its lack of a warning when the battery was about to fail. On the 2500, the transmit-receive LED came on and flashed and there was an audible warning beat, but on the 2600 the battery suddenly just fails, although I was able to get a handle on it after a time because the audio of the unit begins to fade just as the battery is about to go. Still, we wish Kenwood had used an audible warning. But it's a minor point and you quickly get used to the way the rig operates.

Interestingly, if you have a 2500 already, you will find many of the accessories are common to both, such as the MS-1 mobile stand. The speaker-mikes aren't, though, due to pin spacing differences.

The instruction manual, like all Kenwood manuals, is clear and accurate. It easily leads you through the various steps and modes of which this rig is capable. In fact, the rig has so many extra features that it would take far more space than we have here to describe them all.

Suffice it to say, though, that the microprocessor-controlled (CMOS CPU) TR-2600A is an excellent value. It is totally synthesized and offers many built-in features. If you opt for it, you won't go wrong. In fact, with the right accessories, you probably won't need a full-sized mobile rig again. It's that versatile a transceiver.

For more information, contact *Trio-Kenwood Communications, 1111 West Walnut Street, Compton CA 90220.*

Marc Stern N1BLH
Framingham MA

CAGEN CONTEST LOG

By actual count, in my ham shack alone, there are 4,936,233 logging programs for the Commodore 64 computer! Actually, I never was very good at large numbers, and I tend to exaggerate from time to time.

So why should you be interested in hearing about another logging program? Because this one, ladies and gentlemen, is a very fine program.

The very first thing that makes the CaGen program rise above many of the rest is that it is a true machine-language program, through and through. It's designed to handle up to 2500 contacts per file (disk). With that much information, rapid execution of the program is a must, and machine language is the only way to accomplish the needed speed.

Before going further, I must point out that the CaGen program is optimized for contest operation.

To get started, you first have to format a new disk to be used to store your contest files. Like many programs of this type, there are actually several programs included on the same disk. Simply loading "Contest" gives you a menu from which to make your choice.

With your newly-formatted disk in hand and the menu program loaded, you make your first selection. The file-building program creates relative files on your newly-formatted disk. This type of disk file allows for the quickest access to information. This process only needs to be done once for each contest.

From the moment the first menu appears, the CaGen program has a very professional look and feel about it.

Once the file is created, the computer does a "warm start," resets itself, and returns you to the standard C-64 power-up screen. This is true whenever one part of the program finishes. One of the few suggestions I have for improvement would be for the menu to be reloaded rather than for the machine to be reset. There may be programming considerations that don't allow this to happen easily, but it would be nice.

With this done, it's contest time. Selecting the contest log option from the menu, one simple question is asked. You must indicate whether the rules of the contest allow one contact per station per band. This determines how the dupe portion of the program will work.

Inputting the date and time comes next. For some reason (perhaps from VIC-20 training) programmers are in the habit of using the Commodore "TI" clock. It does not remain accurate during many operations. The C-64 has not one, but two honest-to-goodness real-time clocks built in. The CaGen programmers are among the first I have seen to take advantage of these clocks. Their time routines remain accurate regardless of what else is going on.

With a final input to indicate the band and mode, you are on your way. There is little worry of losing your log, since each entry is placed on the disk as you enter it. If you should take a power hit, the worst that happens is you may lose the current contact.

In a contest situation, time is important and the CaGen log requires only a minimum amount of information. You input the callsign and the report received. Everything else is taken care of, including serial numbers.

Changing bands or modes is made very simple. The dupe checking is quick and easy. You can search for a record by callsign or by record number. If you forget any of the commands, a simple "H" for help brings up an information screen.

It is possible to change an entry any time after it has been entered. That's the only point in the otherwise fine documentation where I got a bit confused. A bit of manipulation is necessary to make the update feature work as expected.

A unique feature of CaGen Contest Log is the QSO rate calculator. Whenever you wish, you can have your current QSO rate computed and displayed. The timing program even keeps track of your activity and assumes a break has been taken if you don't log an entry for 30 minutes.

In case you have three pairs of hands and an antenna farm that makes the Voice of America look like a neighborhood radio station, you can log more than 2500 contacts by creating several disks and dividing your log entries for different bands. Having a separate disk for each band is probably extreme overkill, but you could put 80 and 40 on one disk and the high frequencies on another for a total of 5000 records.

After the contest, the CaGen program totally eliminates the post-contest depression of creating the paperwork. Returning to the menu, you can print your log and dupe sheets. All you have to do is make sure the paper to the printer flows smoothly! The reports are nicely formatted and should satisfy even the most critical contest overseer.

I would give the CaGen Contest Log an

WHAT DO *YOU* THINK?

Have you recently purchased a new product that has been reviewed in *73*? If you have, write and tell us what *you* think about it. *73* will publish your comments so you can share them with other hams, as part of our continuing effort to bring you the best in new product information and reviews. Send your thoughts to Review Editor, *73 Magazine*, Peterborough NH 03458.

"A" rating with no reservations. The inclusion of a disk utility option for formatting the blank disk would be appreciated by those of us who can never remember the disk commends. A return to the menu after leaving the various subprograms would make for somewhat smoother operation. Both of these features would be nice to have, but are far from necessary.

If you'd like more information, contact *CeGen Software, 4821 Rosecroft Street, Virginia Beach VA 23464*. Tell 'em good old Jim who has never made more than about 1200 contacts in any contest sent you. Of course, I didn't have a computer then, and propagation was lousy, and I ran QRP, and my neighbors shot down my antennas, and my dog was sick, and my T/R switch broke at the last minute and I had to use a knife switch to change from transmit to receive, and. . .

Jim Grubbs K9EI
Springfield IL

BE MY GUEST

Guest Editorial by Clay Freinwald K7CR

20-KHZ SPLIT

This month we present one side of the 20-kHz repeater spacing issue. In a question-and-answer approach, Clay Freinwald K7CR explores a few of the technical and emotional aspects of the problem. The discussion appeared in the Texas VHF FM Society's newsletter, and describes part of the process used in the Pacific Northwest to move to 20-kHz spacing. While originally written for repeater coordinators, we feel that the clear explanation of the thinking behind the 20-kHz issue is invaluable to the understanding of this controversial issue. We invite our readers to make their feelings known by writing to *73*, 80 Pine Street, Peterborough NH 03458.

Isn't the 20-kHz split a radical approach to the problem?

No, not at all. It may appear radical, but it's just a matter of perspective. Many hams feel that once a set of crystals is installed in a repeater, the system's frequency is cast in stone. This is simply not the case! A change of only 10 kHz is required. Who would not purchase two crystals in order to gain so very much? We made a serious mistake when we kept dividing splits by two—120-kHz spacing became 60, then 30, and now 15 kHz. Now that's radical! Looking back, we should have divided 60 kHz by 3 and saved a lot of people a lot of trouble. This would have been the rational move. And from an equipment-compatibility standpoint, 20-kHz spacing is not radical at all.

What about the cost of changing frequency?

In some cases the 10-kHz change has been accomplished by simply padding the existing crystals. Duplexers, cavities, antennas, and so forth do not have to be modified.

If my repeater changes frequency, what about the users that support the system?

It has been clearly shown all over the Pacific Northwest that users go wherever the repeater goes. At first, some owners were reluctant to change frequency for fear of losing those that had been on the repeater for years or, in particular, those who supported the financial aspects of the operation. Those fears, it turned out, were groundless. . .most people will look up the frequency in the repeater guide, dial it up, and operate.

Don't we want to wait until there is a national band plan before opting to change?

No! First of all, there is no such thing as a national band plan for two meters. We actually have seven different plans for the two segments. From 144.5 to 145.5 MHz we have three: 20-kHz spacing on odd-numbered frequencies (the most popular system), 20-kHz spacing on even-numbered frequencies (southern California), and 15-kHz spacing (Colorado). From 146 to 148 MHz there are four systems: 30-kHz spacing with no splinters, 30-kHz spacing with upright splinters, 30-kHz spacing with reverse splinters, and 20-kHz spacing.

The only "national" system we have is the 600-kHz offset, and in some congested areas this has been altered to squeeze in a few more repeaters at the expense of the simplex frequencies. We in the Northwest looked at all the plans and opted for the one that was the best for us—20-kHz spacing with a 800-kHz offset throughout the band.

Why were the odd-numbered repeaters asked to move?

Even though one additional pair would have been created had we gone to odd-numbered pairs, more repeaters would potentially have had to change frequency. Remember, the first repeaters were on the following pairs: .04/.64, .16/.76, .22/.82, .28/.88, and .34/.94—all even-numbered. Even today, as you drive through the small towns, you'll find that these are the pairs that are in use. In the Northwest we found that only 38 percent of our repeaters were on odd-numbered pairs. In New Mexico it is 44 percent. Simply put, going to the even pairs displaced the least number of repeaters.

Did all repeaters move down 10 kHz?

Generally, yes. This is to make it easier on the users with crystal-controlled radios. It is easier to pad a crystal down in frequency than move it up. In some cases the frequency coordinators asked that a system move up 10 kHz in order to permit better planning on a regional basis, or in cases where a downward move would result in intermod for existing or potential systems. This transition can be viewed as a chance to correct the coordination mistakes of the past. For example, if two machines were on .87/.27 and were interfering with each other, moving one system up and the other down makes good sense.

Can't we put more repeaters on the air using 15-kHz spacing?

The answer is yes. . .but at a price. The price paid is diminished quality. By going to 20-kHz spacing you will gain twelve new pairs in each metro area—pairs that can be reused over and over again following standard co-channel separation criteria. 15-kHz systems must be physically separated. This often requires that they be installed in areas that are undesirable, perhaps even away from populated areas.

All 15-kHz systems operate on a substandard modification of the original 30-kHz plan and actually degrade existing repeaters when they go on the air. With the 20-kHz plan there is no degradation to existing setups, and the newly-created channels are just as good as their neighbors. More repeaters for the sake of more repeaters should not be the goal of any amateur or amateur organization. With 20-kHz spacing there will be 59 viable, quality repeater pairs that should handle the communications needs of any area.

How long will it take for the change to 20-kHz spacing to be complete?

It will take about five years. In the metropolitan areas the pressure for spectrum is greater, so the time frame there is shorter. In rural areas where there is plenty of room, the change may take a long time. This is why, when you look through a repeater directory from the Northwest, you will still see systems on odd-numbered pairs. It is pointless to ask someone to change frequency when nothing will be gained. The five-year period is the same time frame that the ARRL is planning for changing from 15-kHz reverse splinters to upright splinters in some areas.

Has the ARRL recognized the 20-kHz plan?

Yes. In recent issues of the *Repeater Directory*, the League has noted that the Northwest is using 20-kHz spacing. They recognize that local options take precedence.

What does the Northeast part of the country say about all of this?

When asked for comments about the area changing to 20-kHz spacing, they responded that they are against it for one simple reason: They have an admittedly overcrowded band based on 15-kHz spacing, and they have no choice but to live with it. When you ask them what they would do if they had it to do all over again, they say that they would go with 20-kHz spacing. When the new repeater subband opened up, it was 20-kHz spacing that got the votes.

Can't we just leave well enough alone? Aren't there enough repeaters right now?

This sounds great. Unfortunately, there is no method of limiting the number of repeaters. They just keep coming, coordinated or not. A change to 20-kHz spacing would put physics on the side of the coordinators, creating a system where, when the band is full, it is still usable.

It is clear that to continue to fill the band with more and more repeaters is not a solution. A goal of quantity at the expense of quality has never created a better environment. Perhaps this is why the Pacific Northwest was the area to reject the "But we can put up more repeaters with 15-kHz spacing" argument.

Northwesterners are used to clean air and lack of congestion. We are pioneers at heart and don't always follow what has been done in New York or Los Angeles. We didn't on two meters, and as a result, threw out the old 30/15 system in favor of 20-kHz spacing, preferring quality to quantity. The coordinators of the Northwest have rejected the crowded concepts of the Northeast and Southeast as not requested, not required, and certainly not in the best interest of amateur radio.

Clay Freinwald K7CR is a member of the ARRL VHF Repeater Advisory Committee and is frequency coordinator for western Washington.

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

Happy birthday to us, happy birthday to us... Why the festivities? Well because this column is eight years old this month! I've been having a ball writing for all these years, and I hope you have enjoyed reading aa well.

If there has been one overriding theme within this column for the past several years, it has been how technology has radically changed the face of this hobby. Just looking at this column alone, when I started, I wrote each column out in longhand on a yellow pad, edited it, typed out a rough draft on an old manual typewriter, then typed a final draft (or two) for submission. After a while, I started using an electric typewriter, which did wonders for my weary fingers. About five and a half years ago, I started using my 6800 microcomputer as a word processor for the column, starting out with a borrowed dot-matrix printer and progressing to a Selectric. The latest change was to the CoCo, with another type of word processor. After talking to the crew in Peterborough, the next step should be to send the column to them electronically, rather than through the mail—including drawings! Yes, the times certainly are changing.

I know that many of you have come in since then, so maybe a look back would be interesting. My first column, in the June, 1977, issue of *73*, was highlighted by a picture of a Teletype® Model 15 teleprinter and contained a glossary of basic RTTY terms. By the way, an updated version of that column is included in the "RTTY Loop" reprint series. Wayne's editorial that month, under the "Never Say Die" banner, reviewed the then-current state of frequency allotments, fated to change some years later, and also devoted quite a bit of space to the arrival of the microcomputer. Wayne was looking then, as I know he and the rest of the crew still are, for good articles on all the facets of computers in amateur radio. Well, I guess some things never change.

There was one article on RTTY, a design by H. P. Fischer VE3GSP which stored 128 RTTY characters in a 2102 1K static RAM chip. Other articles of related interest included one on programming 82S23 PROMs, the Schottky version of the 8223 fusable-link-type PROM, by R. M. Stevenson WB2CZL, Clay Abrams K6AEP writing about SSTV and the 6800, and an antenna aiming program by Dennis Bodson W4PWF in both Basic and FORTRAN!

The ads? Well, while there were no products specifically directed at the RTTYer, they are quite a trip. From the "barrel of unmarked ICs for $4.00 (we can't test 'em!)" to good old Ampl'Anny, they are a trip in themselves. Oh well, let's bounce back to the present and see what wonders we have in store.

Over the past few months I have mentioned some of the products available in the PBJ CoCo line. This month, let me tell you about the one that causes quite a bit of notice when a visitor stops in the shack, and the one that makes the CoCo much more than a toy. Called "Wordpak," this plain ROMpack-style box plugs into the ROM port or expansion bus and feeds any standard monitor. Its output is an 80-column, 24-line video display with full upper- and lowercase display. Let me tell you, it looks as good on the screen as *any* computer, blue boxes included, and will make your friends sit up and take notice. As if that weren't enough, the engineers have packed enough features into the two versions of Wordpak to satisfy anybody. Cursor positioning, type of cursor, inverse video, and a powerful screen editor are all standard. Additionally, other features such as smooth scrolling, a software-controlled video switch, and a driver in ROM are available, depending on the version chosen. Interested? Drop Al Alberto of PBJ a note at PO Box 813, North Bergen NJ 07047. Be sure to tell him you want the information on Wordpak, as described in this month's "RTTY Loop," OK?

Over the past six months, I have been asking for input as to which programs for the various popular microcomputers you all are using, what you think of them, and other such comments. To date, I have asked about TI-99/4A, Apple II(x), Commodore, TRS-80 Z-80, and TRS-80 CoCo computers. Now, if you are using one of these and have not sent me a note, it's not too late, go ahead and do it now. But this month I would like to hear from the IBM and IBM-clone crowd—all those running the various MS-DOS and PC-DOS machines out there. From previous correspondence I believe that this is sparse territory, so I implore you to write if you are using any kind of RTTY software. I really do want to hear—good or bad.

The author in his natural habitat.

I am sending some of your complaints to the various publishers of the software involved and will ask that their comments be included when the material is published. Hopefully, I should start listing out some of this information within the next few months. Stay tuned!

As my telephone bill continues to mount, I again would like to note that if you would like, feel free to send me comments, questions, or whatever either by mail, that is, United States Postal Service, or via CompuServe. Send mail to the address at the top of this column, and include a self-addressed, stamped envelope if you would like a reply; send CompuServe E-mail to me at user number 75036,2501. I have also been known to hang around the CoCo SIG and occasionally the OS9 SIG. I don't do much browsing—that really does run up the bill!

Oh! The mailbag! Almost forgot all about it. Greetings to Bill Wells WA7YMG. Bill is looking to enter the RTTY world with his Apple computer. Hopefully, we will have some information in these pages about the Apple-compatible software, Bill. Thanks for the interest.

Here's a note from Morris Holliday, who is waiting for his Novice ticket in Gloucester Point, Virginia. Morris is looking to set his Radio Shack PCII up on CW and is looking for a receive program, as well as interface information. Well, Morris, I do not have any information on a receive program, but as a receiving interface, I should think that the PLL design shown here last month should do nicely. Let me know how things come out, and I will forward any information received on this to you.

Regards to David Burkhart N4CPT of Fort Lauderdale, Florida, who is another CoCo user who hopes to be on the air soon. David is interested in RTTY mailboxes, and I am sending him the list printed here a few months back. I would also like to take this opportunity to remind operators of such boards to drop me a note about your operations, so that I can note it here in the column and update the list.

Finally, here is a note from Richard H. Feltner W4ZTC of Safety Harbor, Florida, who writes that with his new Teletype Model 33 he has acquired a Bell-type 101 modem and wonders about the modem's use on the ham bands. Well, Richard, the Bell 101 standards are the commonly used "300-baud" frequencies used for telephone communications with bulletin boards, information services, mainframes, etc. They are not the same as the amateur AFSK frequencies. I don't think that it is practical to modify the modem to send and receive the amatuer frequencies. If you watch this column for the next few months, I think you will see a simple AFSK circuit that will do you fine for ham frequencies. As to the modem: If it works, put it on-line and look for some of the BBSs in your area, or even try some of the national information services.

Well, for those who have asked, and you know who you are, here is a picture of yours truly, sitting at the computer typing away. You see, I really do exist! So that's it for this month, let me hear from you either by mail or wire—I try not to get into the column on the air—and see if you can influence next month's "RTTY Loop."

DX

Chod Harris VP2ML
Box 4881
Santa Rosa CA 95402

FATHER MARSHALL MORAN 9N1MM

Have you worked Nepal 9N1? If you have, the odds are excellent that you worked Father Moran 9N1MM, Nepal's first and only amateur-radio operator. He has practically single-handedly knocked Nepal off the Most Wanted Countries list, while running a missionary school for several hundred young boys. And since Father's Day falls in June, it seems only fitting to honor this father of amateur radio in Nepal, a man who is also the spiritual and academic father to many thousands of young Nepalese.

Father Moran's amateur-radio career spans more than 65 years. He first became interested in radio in 1918, at age 12, when he visited a high school friend whose room was "Heaven for electric and electronics junk," Father Moran remembers. He and his buddy built crystal radios and 5-10-Watt spark transmitters from information in a radio handbook. As with many other radio pioneers, Marshall Moran (as he was then known) and his friend never concerned themselves with licenses!

Then the budding ham moved with his family to Chicago. As with many an amateur moving into a new city, Marshall located the largest antenna in the region and promptly knocked on the door underneath. Inside, a medical student/ham was soldering up an Armstrong superregenerative receiver. There were no ready-made store-bought radios in those days. Fascinated by the three-tube receiver, Marshall carefully copied down all the parts and the simple schematic. A trip to downtown Chicago and $90 later, Marshall was soldering up his first real radio. The young amateur had no trouble making the home-brew receiver work perfectly, and soon KYW, the local Chicago broadcast station, was coming in clearly. Marshall began building radios for family friends at $10 over the cost of the parts. With some of the profits from his electronic assembly business, Marshall read every issue of *QST* and other radio magazines. But he never applied for an amateur-radio license.

Father Moran's radio interests took a back seat to more pressing obligations for a few years, as at the age of 18 he joined the Jesuit Seminary in St. Louis, Missouri. There he studied languages and earned his master's degree and doctorate. After graduation, Father Moran headed for India, where he taught school and provided needed medical care for more than 20 years. And it was there in India that Father Moran's interest in radio resurfaced.

Father Moran was fascinated by the US aircraft in India during World War II, especially their radio communications sets: Hallicrafters SX28s. At the conclusion of the war, he went to purchase some supplies for his expanding school. The shopping list of war surplus equipment included a jeep, 400 beds, and a Hallicrafters SX28!

Father Moran was soon experimenting with various antennas and finally heard W4DPI in Tennessee. "I was in awe!" he remembers. The radio bug bit hard, and

Father Moran continued to try different antennas. Before long he obtained a transmitter and his first amateur-radio license.

Then, in 1951, Father Moran moved to Nepal, a part of the world which dearly needed the kind of school he was operating in India. He located an ideal site for his school: a mountain retreat once used by the Prime Minister of Nepal, but unoccupied at the time. Located in the town of Godawari, near the city of Kathmandu, and nestled at the foot of 9000' Himalayan mountains, the St. Xavier School for Boys has seen more than 20,000 students pass through its doors. 125 kinds of roses dot the property, which boasts a swimming pool, gymnasium, dining room, library, and dormitories for the 260 boys living at the school. Seven Jesuit friars and brothers staff the school, with help from about 30 local inhabitants. In addition to leading the students' education, Father Moran also looks after the students' physical health. Although he never completed his medical training, Father Moran treats many of the minor injuries and even serious diseases of his students. Dysentery, typhoid, and even leprosy are among the ills he has treated. And of course, Father Moran looks after the spiritual growth and well-being of his charges as well.

Getting On The Air In Nepal

When he first arrived in Nepal, Father Moran did not push the issue of amateur radio. "They had no idea what amateur radio was," he explains, "and I didn't want the government to think I was some kind of agent, so I didn't do anything" about getting on the air.

Then, in 1960, a small group of American engineers arrived in Nepal to set up a telephone and telecommunications system for the government. As part of the contract to do the work, each engineer (all hams, obviously) requested an amateur-radio license and callsign. Father Moran had no trouble convincing the engineers to add his name to the list of licensees. So Sam Maso, Tom Bell, Fred Vocal, and Father Marshall Moran were soon sporting new callsigns: 9N1SM, -TB, -FV, and 9N1MM. Father Moran was clearly eager to get back on the amateur bands; he got license #1!

To get on the air, Father Moran began to assemble a Heathkit® Cheyenne transceiver. There was no one in Nepal to whom he could turn for assistance. Father Moran probably knew more about electronics and radio than anyone else in the country at the time, aside from the visiting engineers—and none of them had ever assembled such a radio. "I took it very slowly and carefully," he says, "green wire to L1 (S2)." Soon Father Moran and the engineers were on the air, with a local net on 10, 15, or 20 meters AM.

When the engineers had completed their job, and the contract expired, Father Moran convinced the Nepalese government to continue amateur radio, and in particular to continue license #1, 9N1MM, by demonstrating the utility of the service, especially the lower bands, for communications throughout Nepal. The government indeed saw the advantages of radio communications and has continued to renew Father Moran's license every year since. However, this government interest has cost Father Moran the use of the 80-meter band. Hundreds of government stations now use the band, rendering it unusable for amateur radio.

He hasn't done too badly on the other bands, however. Father Moran worked his first 100 countries within weeks of getting a single-sideband rig. Over the past 25 years that he has been licensed in Nepal, he has made more than 250,000 contacts, and he and his QSL manager N7EB have sent out more than 80,000 9N1MM QSL cards. Once in the Top Ten Most Wanted list of amateur-radio countries, Nepal no longer ranks in the top 73, thanks almost entirely to Father Moran.

He is also one of the original members of the Southeast Asia Net, SEANET. Amateurs from Singapore, Hong Kong, Australia, New Zealand, and Thailand began meeting at 1200Z. This is 5:00 pm local time for Father Moran, an ideal time to be on the air from Nepal. After working hours, but before the bands opened up to Europe and the States, Father Moran ran SEANET. In addition to calling the net for many years, he has frequently attended the annual SEANET conventions scattered throughout Southeast Asia. In fact, he was asked to preside over the first SEANET convention, in Bangkok. His convention travel and his extended trip through the United States in 1984 are financed solely by contributions from other amateurs.

Father Moran's station is supported in the same manner—by the generosity of fellow hams. When some stateside hams mentioned that 9N1MM sounded weaker than usual, Father Moran explained that in order to rotate his antenna, he had to climb up and turn it with a wrench. A new rotor and control box arrived in Nepal soon thereafter. And when his well-used, 18-year-old Drake TR4 finally gave up the ghost, the R. L. Drake Company donated a new TR7 to the 9N1MM shack. Another time the Arabian Knights Net chipped in and sent a TH6 tribander to Nepal.

Besides operating, Father Moran's favorite amateur-radio activity is experimenting with antennas. He spent his last Christmas holiday in Nepal erecting a wire log-periodic antenna, aimed over the North Pole. "It's a good compromise between Europe and the States," he explains.

Father Moran operates almost every day of the year. Each morning, after the boys complete their morning calisthenics and Father Moran holds morning sick call, he tunes up on 20 meters, around 14215–35 kHz. Early morning local time turns into 0030-0200 UTC. Father Moran is frequently on the air in the evenings as well, beginning about 1200 UTC with SEANET and often after dinner, too. He prefers rag-chews to contest-style contacts and can even be worked on a list (see box).

Father Moran is not a "card collector," as he terms an avid DXer. He explains why: "I think it is more important for me to give people reports than for me to work a 'new one.' I don't even know how many countries I have worked. Probably about 300. But if you go for new countries too much, you ignore dozens and dozens of good fellows who would never work Nepal. Someone with a call like mine should spread it around as much as he can." DXers the world over are fortunate that Nepal's only amateur has this attitude!

When the 9N1MM callsign shows up in a radio contest, chances are that a visiting amateur is at the key or mike. Contests are definitely *not* Father Moran's favorite radio activity. As for a serious contest operation from Nepal, he confesses, "I fall asleep." And when it comes to getting on during a contest and giving out some multipliers, "I need a secretary or a computer. I keep calling the same stations over again."

FATHER MORAN 9N1MM ON LIST OPERATIONS

Every Thursday I work stations off of a list. I do this because many amateurs still need a contact with Nepal. Some hams hate lists. I think that attitude is alright for the guys with lots of money and power and good locations. But what about the little guy with 100 Watts and a dipole and limited income? I am sure they get more fun out of the Nepal contact, and with the list they have a chance. Besides, I only operate from a list once a week; the other six days the Big Guns get their chance, so they shouldn't complain.

Father Marshall Moran 9N1MM is the father of amateur radio and the only licensed amateur in Nepal.

Fortunately for contesters, almost every week another visitor drops by the St. Xavier School. Many of the visitors are hams, and many guest-operate the only amateur-radio station in the country.

Among the many noteworthy visitors to 9N1MM's small shack was Juan Carlos, King of Spain. The King was fascinated by the radio gear, and soon after his return to Madrid, the King was on the air as EA0JC, with a complete Drake line, just like his friend Father Moran. An autographed photograph of the King with his gear graces the 9N1MM shack. In another brush with royalty, Father Moran recalls his first contact with JY1: "He was my first Jordan contact, and I asked where to send my QSL." "To the Palace," came the reply, from King Hussein JY1!

One recent ham visitor was very active from 9N1MM. Tom Dugec YU2DX was a member of the Manaslu-83 Yugoslavian mountaineering expedition to Nepal. Tom spent a month operating 9N1MM as Father Moran's guest, while maintaining radio contact with the mountaineers. Tom amassed 13,100 contacts before the expedition was called off, after two climbers were killed in an avalanche. He describes some of his feelings about the visit:

"After a short period I became part of the school. Youngsters passed by, greeting me with a smile and 'Good morning, Father Tom.' Never in my life have I felt so good and warm inside. Father Moran is one of the most exceptional people that I have had the privilege to know. He is 76 (now 78) years young and has devoted his entire life to missionary work in India and Nepal. I can only say 'Thank you Father Moran for such a wonderful experience and for all the help you have provided.' "

Father Moran had slightly different recollections of Tom's visit. "Tom worked over 6000 contacts on CW, which is good since I don't handle CW. However, he was a chain smoker, and I wouldn't let him use my shack. I ran coax around to the library and set him up on a table, where he could smoke his head off. 'Tom,' I said, 'I'm so sorry about your wife and family, having to put up with that terrible smoking and your shortened life span.' I hear that Tom quit smoking after his return to Yugoslavia."

Between hosting visiting operators, Father Moran continues his efforts to expand amateur radio in Nepal. A few years ago some stateside and Japanese amateurs, including Rusty Epps W6OAT, operated a special-event station in celebration of the King's birthday. In preparation, Father Moran had loaned the Director of Communications of Nepal an unused receiver. Father Moran also loaned some coax and strung up an antenna for the Director. Soon the Director was avidly logging callsigns. During the birthday celebration, Father Moran personally guided the Director through the various amateur stations explaining the benefits of ham radio. Father Moran has also pleaded the case of amateur radio directly with the King of Nepal and has obtained written authorization for the amateur service. Perhaps this means that someday more than one amateur will be licensed in Nepal. Meanwhile we are all fortunate to have such an outstanding individual keeping 9N1 off the Most Wanted lists. Among the best aspects of DXing is the opportunity to meet and get to know wonderful people such as Father Marshall Moran 9N1MM.

Special thanks to Tom Dugec YU2DX and the Northern California DX Foundation (NCDXF) for parts of the above. The NCDXF sponsors DXpeditions, runs the 20-meter beacon system, and assists DXers worldwide. For more information on the NCDXF, write them at PO Box 2368, Stanford CA 94305 USA.

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

ARRL VHF QSO PARTY
Starts: 1800 UTC June 8
Ends: 0300 UTC June 9

Sponsored by the ARRL, the object is to work as many amateur stations in as many different ARRL sections and countries as possible using authorized amateur frequencies above 50 MHz. Note that these rules were taken from previous years' contests and no changes were anticipated. This year's rules were not available early enough to make this column, so you may want to check *QST* for any last-minute changes.

Operating categories include single operator using multi- or single band, or multi-operator. Single-operator stations must use one person for all operating and logging functions. Single-operator stations may submit single-band scores for 50, 144, 220, 432, and 1296-and-up categories. Contacts may be made on any and all bands without jeopardizing single-band-entry status. Such additional contacts are encouraged and should be reported.

Multi-operator stations must locate all equipment (including antennas) within a 300-meter-diameter circle.

Stations may be worked once per band, regardless of mode. Each QSO must be acknowledged; one-way exchanges do not count. Foreign stations may work only stations in the USA, Canada, and US possessions for contest credit.

Retransmitting either or both stations, or use of repeater frequencies is not permitted. Contest entrants may not transmit on repeaters or repeater frequencies on 2 meters to solicit contacts. Use of the national calling frequency, 146.52, or immediate adjacent guard frequencies is also prohibited. Only recognized simplex frequencies may be used, such as 144.90-145.10, 146.49/.55/.58, and 147.42/.45/.48/.51/.54/.57 MHz on the 2-meter band. Local option simplex channels and frequencies adjacent to the above that do not violate the intent of the contest rules or the spirit and intent of the band plans as recommended in the *ARRL Repeater Directory* may be used for contest purposes.

All operation must be fixed, portable, or mobile under one call from one ARRL section. A transmitter used to contact one or more stations cannot be used under any other call during the contest period, with the exception of family stations where more than one call is assigned to one location by FCC/DOC. Also, one operator may not give out contest QSOs using more than one callsign from any one location.

Only one signal per band at any given time is permitted, regardless of mode. While no minimum distance is specified for contacts, equipment should be capable of real communications (i.e., able to communicate over at least a mile). Multi-operator stations may not include QSOs with their own operators except on frequencies higher than 2.3 GHz. Even then, a complete, different station must exist for each QSO made under these conditions.

Above 300 GHz, contacts are permitted for contest credit only between licensed amateurs of Technician class or higher using coherent radiation on transmission (e.g., laser) and employing at least one stage of electronic detection on receive.

EXCHANGE:

Name of section, VE province, or DX country. Must be acknowledged by both operators for credit by either.

SCORING:

Count one point for each complete 50- or 144-MHz QSO, 2 points for 220 or 420 MHz, and 3 points for 1215 MHz and above. Crossband QSOs do not count.

Multipliers are each ARRL section in the contiguous 48 states (63 maximum), each Canadian province (maximum 12), and each DXCC country (excluding W and VE). Multipliers count once per band.

REPORTING:

Entries must be postmarked no later than July 11th and sent to the ARRL, 225 Main Street, Newington CT 06111. Official entry forms are available from the same address for an SASE. Usual ARRL disqualification rules apply. Usual awards to top scorers in each ARRL section, some limited to where significant effort or competition is evidenced. Multi-operator entries are not eligible for single-band awards.

WORLDWIDE SOUTH AMERICA CW CONTEST
Starts: 1500 UTC June 8
Ends: 1500 UTC June 9

Sponsored by *Electronica Popular* magazine of Rio de Janeiro, Brazil, this contest will be held annually on the second weekend of June. Use all bands, 80 through 10 meters, on CW only; crossband contacts are not valid. Only contacts between

CALENDAR

Jun 8-9	Worldwide South America CW Contest
Jun 8-9	ARRL VHF QSO Party
Jun 22-23	ARRL Field Day
Jun 28-30	Summer SMIRK Party
Jul 1	CARF Canada Day Contest
Jul 13-14	IARU Radiosport Championship
Jul 20-22	CQ Worldwide VHF WPX Contest
Aug 3-4	ARRL UHF Contest
Aug 17-18	New Jersey QSO Party
Aug 17-18	SARTG Worldwide RTTY Contest
Sep 14-15	ARRL VHF QSO Party
Sep 14-16	Washington QSO Party
Sep 28-29	Late Summer QRP CW Activity Weekend
Oct 5-6	ARRL QSO Party—CW
Oct 12-13	Rio CW DX Contest
Oct 12-13	ARRL QSO Party—Phone
Oct 19-20	ARRL Simulated Emergency Test
Nov 2-3	ARRL Sweepstakes—CW
Nov 16-17	ARRL Sweepstakes—Phone
Dec 7-8	ARRL 160-Meter Contest
Dec 14-15	ARRL 10-Meter Contest

RESULTS

1985 WORLD SSB CHAMPIONSHIP CONTESTS
CLAIMED SCORES

Callsign	QSOs	States/ Provinces	Countries	Claimed Score
20-Meter Single Op				
1. NR5M	1690	59	51	1,092,300
2. KA1GG	924	50	65	814,775
3. W1BR	904	54	58	775,040
4. W5FO	913	57	48	572,250
5. OK1TN	534	46	56	445,230
20-Meter Multi-Op				
1. K5LZO	1473	56	57	932,815
2. KE7C	1171	55	29	559,860
3. KA1YR	501	46	54	360,500
4. KD5RW	411	46	13	133,045
5. WBØOIZ	343	39	14	96,460
40-Meter Single Op				
1. KE5CV	1200	56	47	704,520
2. K4XS	1196	53	38	567,840
3. N6YK	1012	55	32	539,400
4. KE5IV	1009	53	30	443,635
5. NC2V	931	52	20	344,520
40-Meter Multi-Op				
1. K3TUP	1381	55	29	597,240
2. KYØS	1139	55	28	512,940
3. WA4JXI	990	57	32	468,585
4. N4DDS	1151	54	12	385,770
5. KS9O	946	55	22	374,990
160-Meter Single Op				
1. N7DF/Ø	1177	56	13	411,240
2. WØEJ	1152	56	13	401,580
3. KI2M	841	54	27	363,690
4. WB9NUL	575	55	9	282,880
5. W1ODY	690	47	15	228,890
160-Meter Multi-Op				
1. WB8IFP	1054	56	8	340,160
2. WØCEM	1084	56	5	332,450
3. W8RA	754	56	15	272,995
4. NO4R	871	53	8	268,095
5. WA4JXI	536	54	33	250,995

Claimed scores for the 15-meter and 75-meter events will appear in a future issue. Final results will appear this fall.

NEWSLETTER OF THE MONTH

Sunny southern California is the home of the Fresno Amateur Radio Club, publishers of *Skip*, June's Newsletter of the Month.

It's readily apparent that Editor Don Mayer N6EMV has his hands full covering the varied activities of this active and growing club. Yet Don somehow manages to include just about everyone in each issue, a trick that editors of faltering journals should make full use of.

Like many of our winners, *Skip* is printed in a magazine-like format which balances editorial content with paid advertising. The result is a professional-looking publication that nearly pays for itself!

To enter your club's newsletter in *73*'s Newsletter of the Month Contest, send it to *73*, 80 Pine Street, Peterborough NH 03458, Attn: Newsletter of the Month.

South American stations and stations in other continents are considered for scoring. A station may only be worked once on each band. Entry classes include single operator, single band or allband, and multi-operator, single transmitter (multiband only).

EXCHANGE:

RST and consecutive QSO number starting with 001.

SCORING:

Each QSO counts 2 points. Contacts between South American stations count only as multipliers, not as QSO points. For South American stations the multiplier is the number of different countries worked on each band. For others, the multiplier is the number of different South American prefixes worked on each band. The final score is the sum of QSO points multiplied by the sum of multipliers.

AWARDS AND ENTRIES:

Certificates will be awarded to the three top-scoring stations in each class and to the top scorer in each country. A separate log for each worked band must be sent no later than Aug 31st to WWSA Contest Committee, PO Box 18003, 20772 Rio de Janeiro, RJ Brazil.

ARRL FIELD DAY
Starts: 1800 UTC June 22
Ends: 2100 UTC June 23

Note that these rules were taken from previous years' contests and no changes were anticipated. This year's rules were not available early enough to make this column, so check *QST* for any last-minute changes.

Sponsored by the ARRL, the contest is open to all amateurs in the ARRL Field Organization plus Yukon and NWT. Foreign stations may be contacted for credit, but are not eligible to compete. The object is to work as many stations as possible under less-than-ideal conditions. Operating times are limited, depending on your operating class; check rules below.

Entry categories are classified by the maximum number of simultaneous transmitted signals, followed by the designation of the nature of the individual or group participation. Below 30 MHz, a transmitter must remain on a particular band for at least 15 minutes once used for a contact on that band. During this 15-minute period, the transmitter is considered to be transmitting a signal (even if it is not) for purposes of determining transmitter class. Switching devices are prohibited.

Class A consists of club and non-club portable stations specifically set up for Field Day. Such stations must be located in places that are not regular station locations and must use no facilities installed for permanent station use nor any structures installed permanently for FD use. Stations must be operated under one callsign and under the control of a single licensee or trustee for each entry. All equipment (including antennas) must lie within a 300-meter-diameter circle. All contacts must be made with transmitters and receivers operating independent of commercial mains. Entrants who, for any reason, operate a transmitter or receiver from commercial mains for any contacts will be listed separately at the end of their class.

Any Class A group whose entry classification is two or more transmitters (non-Novice) may also use one Novice/Technician operating position (Novice bands only) without changing its basic entry classification. This station (including antennas) should be set up and operated by Novice and Technician licensees and should use the callsign of one these operators.

Class B consists of non-club portable stations set up and operated by not more than two licensed amateurs. Other provisions are the same as for Class A.

Class C consists of mobile stations in vehicles capable of operation while in motion and normally operated in this manner, including antenna. This includes maritime and aeronautical mobiles.

Class D consists of stations operating from permanent or licensed station locations using commercial power. This group of stations may only count contacts made with Class A, B, C, or E Field Day groups for points.

Class E stations are the same as Class D except for using emergency power for transmitter and receivers. They can work stations in all classes.

Operators participating in FD may not contact for point credit the FD portable station of a group with which they participate. Any station used to contact one or more FD stations may not be used under any other call during the FD period, except for family stations.

Each phone and each CW segment is considered as a separate band. All voice contacts are equivalent, and RTTY/ASCII is counted as CW. A station may be worked once on each band, and crossband contacts are not allowed. The use of more than one transmitter at the same time in a single band is prohibited, except that a Novice/Technician position may operate on any Novice band segment at any time. No repeater contacts are allowed.

EXCHANGE:

Stations in any ARRL section send Field Day operating class and ARRL section. A four-transmitter station in NJ would send "4A NJ." Foreign stations send RS(T) and QTH.

SCORING:

Scores are based on the number of valid contact points times the multiplier corresponding to the highest power used at any time during the FD period, plus bonus points. Phone contacts are one point each, CW counts two points each. Power multipliers are: 5 for using a dc input power of 10 W (20 W PEP) or less (5 W dc output, 10 W PEP output) with a power source other than commercial mains or motor-driven generator; 2 for using a dc input power of 200 W or less on CW and 400 W PEP or less on SSB; 1 for using anything higher.

Batteries may be charged while in use for Class C entries only. For other classes, batteries charged during the FD period must be charged from a power source independent of the commercial mains.

Bonus points will be added to the score (after the multiplier is applied) to determine the final score. Only Class A and B stations are eligible for bonuses:

1) *100% Emergency Power*—100 points per transmitter for 100% emergency power. All equipment and facilities at the FD site must be operated from a source independent of the commercial mains.

2) *Public Relations*—100 points for public relations. Publicity must be obtained or a bona fide attempt to obtain publicity must be made, or operation conducted from a public place (such as a shopping center). Evidence must be submitted in the form of a clipping, a memo from a BC/TV station that publicity was given, or a copy of material that was sent to news media for publicity purposes.

3) *Message Origination*—100 points for origination of a message by the club president or other FD leader, addressed to the SM or SEC, stating the club name (or non-club group), number of operators, field location, and number of ARES members participating. The message must be transmitted during the FD period, and a fully-serviced copy of it must be included with the FD report. The message must be in standard ARRL message form or no credit will be given.

4) *Message Reply*—10 points for each message received and relayed during the FD period, up to a maximum of 100 points. Copies of each message, properly serviced, must be included with the FD report.

5) *Satellite QSO*—100 points can be earned by completing at least one QSO via satellite during the FD period. The repeater provision is waived for satellite QSOs and a satellite station does not count as an additional transmitter. Show satellite QSOs as a separate band on the summary sheet.

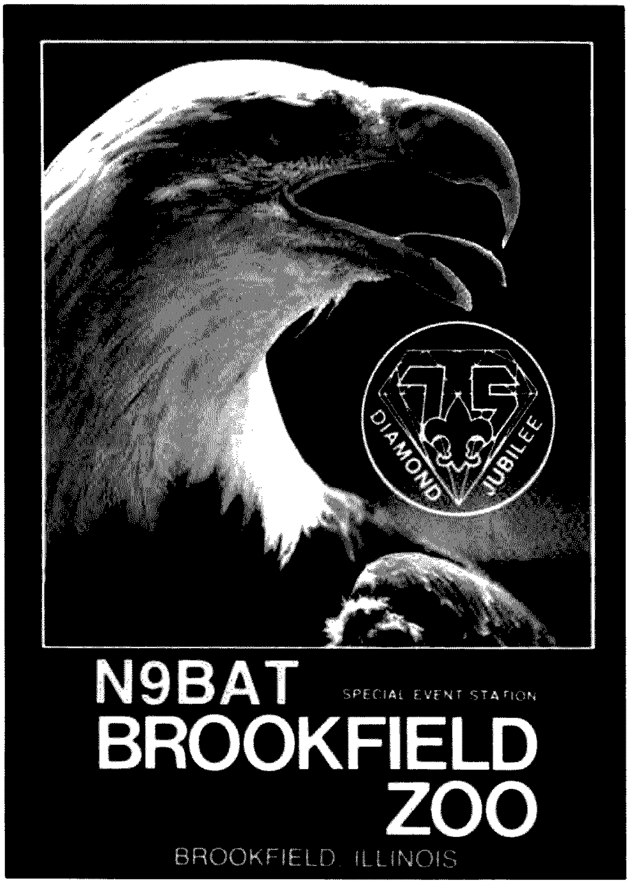
6) *Natural Power*—FD groups making a minimum of 5 QSOs without using power from commercial mains or petroleum derivatives can earn 100 points. This alternative power source also includes batteries charged by natural means (not dry cells). The natural-power station counts as an additional transmitter. If you do not want to change your entry class, take one of your other transmitters off the air while making the natural-power QSOs. A separate list of natural-power QSOs should be enclosed with your entry.

7) *W1AW Message*—A bonus of 100 points will be earned by copying a special ARRL FD bulletin sent over W1AW on its regularly announced frequencies just before and during FD. This message can be received directly from W1AW or by any relay method. An accurate copy of the received message should be included in your FD report.

REPORTING:

Entries must be postmarked by July 24th; no late entries can be accepted. A complete entry consists of a summary sheet and a list of stations worked on each band/mode during FD, plus bonus proof. The list of stations worked on each band or mode may take the form of official ARRL dupe sheets or an alphanumeric listing of callsigns worked per band and mode. This list may be computer generated. Incomplete or illegible entries will be classified as check logs. A copy of FD logs should be kept by your FD group but should not be sent in unless specifically requested by the ARRL. Normal ARRL disqualification rules apply.

All entries and requests for official forms should be addressed to: ARRL, 225 Main Street, Newington CT 06111. Include a 9" by 12" SAE with 3 oz. postage for a complete Field Day entry package.



QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, 80 Pine Street, Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

SUMMER SMIRK PARTY
Starts: 0000 UTC June 29
Ends: 2400 UTC June 30

Sponsored by the Six-Meter International Radio Klub (SMIRK). No crossband contacts, multi-operators, or partial contacts. Check logs or dupe sheets are not needed.

EXCHANGE:

SMIRK number and ARRL section, for-

CONTEST COMMITTEE NEEDS HELP!

The World Championship Contests are growing each year! It is more than our present staff can handle. 1986 is expected to break all records to date. Here's your chance to join the volunteer staff of *73*'s prestigious contest committee. If you understand contesting, we need YOU! Contact Bill Gosney KE7C, 2665 N. Busby Road, Oak Harbor WA 98277.

eign state, province, prefecture, or country. Count ARRL sections in the 48 US states only; KH6 and KL7 count as countries. Washington DC counts as a section as well. Canadians count as provinces; all others count as states, provinces, prefectures, or countries.

SCORING:

Count 2 points for each SMIRK contact, 1 point for non-SMIRK QSOs. Add QSO points and multiply by number of ARRL sections, foreign states, provinces, prefectures, or countries worked for final score.

AWARDS:

Certificates for high-scoring SMIRK in two divisions: US/Canada and foreign. Certificates for high score in each ARRL section and foreign state, province, prefecture, or country.

ENTRIES:

Entries must be submitted on the Fall, 1981, edition of the official SMIRK log. Single copies are available for an SASE and photocopies may be used. Send log requests and entries postmarked by July 31st to: Mark S. Anderson WB5NPK, 8932 Saddle Trail, San Antonio TX 78255.

HAM HELP

I am trying to find a schematic for a Lafayette model HE-80 receiver. Will purchase or pay all costs for copy.

Norman Murchland
8440 Sheraton Dr.
Miramar FL 33025
(305)-431-2881

In order to resurrect my Centronics 101 printer, I need the following parts: reference number HD6, part number 525130001, part name "Packing," and part number 527363001, part name "Damper." These numbers are from Centronics' technical manual for the Model 101 printer, revision D, dated March, 1975, figure 8-5.

R. J. Pinkerton W4VMQ
2500 O'Neal Circle
Birmingham AL 35226

ATTENTION
SUBSCRIBERS

We occasionally make our mailing list available to other companies or organizations with products or services which we feel might be of interest to you. If you prefer that your name be deleted from such a list, please fill out the coupon below or affix a copy of your mailing label and mail it to:

C.W. Communications/Peterborough
73 for Radio Amateurs
P.O. Box 931
Farmingdale, NY 11737

Please delete my name from mailing lists sent to other companies or organizations.

Name ______________________

Address ______________________

City ____________ State ________ Zip ________

73 for Radio Amateurs

LETTERS

FT-301 OWNERS

I have had some trouble with my FT-301. The RX and TX were offset about 130-150 Hz on all bands in all modes, and you can see the problem that will cause if you're on RTTY.

While I don't pretend to take original credit for this modification, I must say I have never seen it in any ham magazine or other publication (unless it pertained to the 101 series).

Apparently, on late production models of the FT-301, Yaesu made a factory modification on the premix unit (PB 1439A) in which TX 13.5 V dc is routed to pin 11 of the board and is used to provide forward bias to D701 via R723. This puts C720 (in an rf voltage divider) across pin 8 of mixer chip Q701.

The result of the application of the TX 13.5 V dc to pin 11 causes enough loading of premix oscillator Q702 to pull the crystal frequency by approximately 150 Hz. This is due to the lower injection voltage in TX only. The problem can be solved by lifting the red wire connected to pin 11 (the RX 13.5 V dc) off pin 11, thus allowing the injection voltage to the mixer to remain constant both in RX and TX. Tape the end of the red wire.

I have noticed no adverse effects in this simple modification, and the RX and TX frequencies are the same. My RTTY problem has been solved.

R. G. Lyon K4FXP
Satellite Beach FL

MAJORITY RULE

I'm not much of a letter writer, but I have heard about all the noise I can stand over the no-code license. The stand taken by the ARRL was a reflection of the views of its members. If people don't like it, then they should join the group and let their feelings be known. If the majority of hams are in favor of the no-code license, then why haven't they made their voice heard? The only way for the hobby to be satisfactory for the majority is for that majority to have a strong collective voice. In the matter of no-code, I think the wishes of the majority have been carried out.

The excuse of needing a no-code license for those who would like to design, build, and otherwise enjoy the many facets of digital electronics is very weak and not valid at all. All this super-fast transfer of information is best carried out over wire line anyway. How many hours of phone time could you use in packet exchanges before you spent the same amount that a rig and antenna would cost?

Your idea of retesting for CW wasn't too bad. That makes more sense than the no-code. After all, there is still CB.

I enjoy your magazine and your ability to make money! I am trying to use some of your tips myself.

Monte "Ron" Stark KU7Y
Nampa ID

IC-71A OWNERS

I have an IC-71A with a problem similar to that mentioned in your review of Stop-Scan in the February, 1985, issue.

The instruction manual claims that the unit stops for 10 seconds then resumes scanning. Mine stopped, but I had to depress Scan to start it again. Figure 7-3, on page 20 of the manual, depicts a scan/stop switch. I suspected that it was set in the wrong position. Well, the 10-second feature showed up after changing the switch's position.

However, two new problems were present. During scanning, the receiver skipped stations, and I suspected that it was due to an excessive scan speed. Referring back to Figure 7-3, I found scan adjuster R14. This pot was fully clockwise. Turning it fully counterclockwise caused the scan to stop. I simply adjusted R14 until the problem went away.

Still, I had the annoying problem of having to push Scan twice to resume scanning. Back inside the rig, I reset the scan/stop switch to its original position. Now, only one depression causes resumption of scanning. And holding Scan down results in continuous scanning. Much better. Frequency stability is better than 100 Hz even after 14 hours, and frequency accuracy is better than 100 Hz, based upon copying an SSB signal for one hour with no discernable change in pitch.

Edward J. Campbell
Yonkers NY

ALL THIS AND MORE

I really enjoyed "All This and PCIII" by Bob Lockwood W4FXI, in the March, 1985, issue. It was a useful application for the portable pocket computer.

Upon entering the program I found that the fixed- and variable-memory functions did not work, but the keyboard-direct mode did work as advertised. One thing led to another, a fix was entered, and with the assistance of WA1SZU and AF1A I decided to add a few additional features.

The program lines in Listing 1 will: increase variable- and fixed-memory space to 80 instead of 16 characters, define "space" to separate words for proper CW timing, speed up the wpm adjustment, add "?" to the CW table (using the period key), and display the characters as they are sent.

These are only our changes—please enter all the other lines as printed in the article. If anyone else comes up with other enhancements, I would be most interested in hearing from them.

Dave Faucher WA1UQC
Collinsville CT

```
1   DIM B$(1)*80: DIM F$(1)*80
4   J=LEN B$(1)
7   A$=MID$(B$(1),C,1)
8   GOTO 13
13  WAIT 0: PRINT LEFT$(B$(1),C)
83  IF A$="." THEN LET A$="112211": GOTO 100
85  IF A$=" " THEN LET A$="0": GOTO 100
109 GOSUB 137
116 IF C<J THEN 6
120 F$(1)="": INPUT F$(1)
124 B$(1)="": B$(1)=F$(1): GOTO 4
126 B$(1)="": B$(1)="DE URCALL": GOTO 4
128 B$(1)="": B$(1)="UR RST IS": GOTO 4
130 B$(1)="": B$(1)="UR QTH": GOTO 4
132 B$(1)="": B$(1)="UR NAME": GOTO 4
134 BEEP 1,28,90: RETURN
136 BEEP 1,28,300: RETURN
137 WAIT 0: RETURN
```

Listing 1. Enhancements to Lockwood's "All This and PCIII" in March, 1985.

WHY SHOOT J. R.?

In response to the letter from J. R. Russell in the March, 1985, issue: While crossbanding is legal under current FCC rules, it is a very sleazy practice. It takes up 40-50 kHz of spectrum that could be available to other amateurs. I've been caught calling CQ on a DX operator's "window" and can testify to how rude these DX operators can be.

Al Winters WA6FFV
Richmond CA

The whine of J. R. Russell KA6FCM in your March, 1985, issue that foreign operators dare to use "Novice" bands for anything other than CW prompts this reply:

You, sir, are typical of a growing number of inconsiderate (*deleted*) who believe the sun rises and sets according to the American practice and who blissfully ignore the rest of the world.

You, I suppose, are one of the American CW operators who consistently interfere with public-service phone nets operating between 3775 and 3725 kHz in Canada and ignore all requests to QSY. Or are you one of those boors who has decided that if you can't operate phone below 7100 kHz, then those damn foreigners can't either?

For goodness sake, sir, get a *Callbook*. Or a copy of the ARRL logbook. Or *The ARRL Handbook*. Any of them will contain a list of prefixes and/or band plans. And listen. Listen a *lot*. You may even discover that there are operators *beyond* the boundaries of the United States!

The United States has given the world many wonderful things and has some of the nicest, most considerate, and competent radio operators in existence. Unfortunately, it has also given us Citizens Band radio and J. R. Russell KA6FCM.

Robert Smits VE7EMD
Surrey BC

Seems we've really struck a nerve here! Both of you, though, have missed the point.

Al—The operation was split-frequency, not crossband, and occupied at most an extra 3 kHz, assuming both stations were using SSB. As for DX "windows," there are countries where these slices of spectrum are the only spots available for use. A gentleman will avoid treading upon them out of goodwill.

Robert—Your criticisms are valid, but to focus them all on a single Novice is hardly fair. Remember when you were a beginner?—Ed.

WHAT PRICE QSL?

To Amateur Radio Station H44IA
Honiara, Solomon Islands

I recently sent you a QSL card for a contact we had on 40-meter CW, February 18th at 1210Z. I enclosed a self-addressed, stamped envelope with Solomon Island postage to be used to return your card to me.

Today, I received my envelope back in the mail. Instead of the expected H44IA card, you had returned my card with a note: SORRY BUT 50¢ STAMP DOES NOT HELP TO RUN THIS END.

The 50¢ stamp was not intended to help "run" your end. It was intended to pay the postage for your card back to me. The postage was adequate since you used my SASE to return my card to me. If you can't afford the hobby, you shouldn't be in it. The 50¢ Solomon Island stamp cost me more than $1.00 here and was simply a goodwill gesture to defray your expense for sending a QSL card to me.

I think you are a disgrace to amateur radio, since you are obviously trying to *sell* QSL cards. I believe this is your home station, not even a DXpedition operation, so even a request for a donation would be out of place.

I do not feel that your station should be accredited to count for any of the DX awards. I think it should be categorized the same as a station with invalid credentials. I will send a copy of this letter along with copies of my return envelope and both sides of my returned QSL card to all of the major organizations who sponsor DX awards and DX contests. In addition, I will send a copy to the agency that licenses amateurs in the Solomon Islands. In the US an amateur station is not to be used for monetary gain, in *any* way.

Warren Ash AK2H
Kingston NY

BLOOMING

Once in a while there comes along a writer able to clearly and concisely express himself to the reader, one who obviously knows his subject, and one who wastes no words when writing. Such an author is Robert Bloom W6YUY. Congratulations to the author for the writing and to the Editor for publishing "Swr: A Modern Myth?" in the February, 1985, issue.

How about having W6YUY write on amateur applications for varying the height of antennas with telescoping towers to accommodate operational wavelength and antenna height above effective ground? Shouldn't this increase effective radiated power without more Watts input? What are the techniques for "tuning" the antenna height?

Or, how about a discussion and explanation of the use of a variable-length dipole? Didn't the military at one time use a 2-reel steel tape at the center of a dipole to provide wavelength selection? There must be a way, within amateur limits, to successfully vary a dipole's length.

Claude Holmes WS4D
Coral Gables FL

HAM HELP

We are happy to provide Ham Help listings free, on a space-available basis. We are not happy when we have to take time from other duties to decipher cryptic notes scrawled illegibly on dog-eared postcards and odd-sized scraps of paper. Please type or print your request (neatly!), double spaced, on an 8½" × 11" sheet of paper and use upper- and lowercase letters where appropriate. Also, please make a "1" look like a "1," not an "l," which could be an "el" or an "eye," and so on. Hard as it may be to believe, we are not familiar with every piece of equipment manufactured on Earth for the last 50 years! Thanks for your cooperation.

I need the schematic and manual for a Corbin-Famsworth Scopette model SCPT-4, circa 1960. The clicker accessory schematic would also be helpful. The SCPT-4 is a piece of medical electronic equipment showing EKG and EEG tracings on a slow-decay phosphor scope. Copies and postage paid.

Ronald Young WB2JJX
36 Brompton Rd.
Garden City NY 11530

I need an owners/service manual for a Regency HR-212 2-meter transceiver. I will reimburse copying costs or will photocopy and return the original.

James Lee WB4GWX
5004 Ridge View Court
Fort Worth TX 76118

I need information on a Dynamic Communications, Inc., 2-meter amplifier, model 101-5000.

Stephen L. Ford N4LNB
Rt. 1, Box 7
Bristol FL 32321

I need schematic and alignment instructions for a Hammarlund model HQ-105TR or HQ-100, which I think is the HQ-105TR without the CB transmitter. I will pay the cost of copying and postage. Also, I need schematics for an RCA WO-88A oscilloscope and a Hickock model 6000A tube tester.

Paul Van Nostrand W4HVD
3725 Lifford Circle
Tallahassee FL 32309

Does anyone have drawings of the coil winder I have heard the old-timers talk about?

Bill Boyer KA5IJBK
Route 4, Box 1079
Hattiesburg MS 39401

I am in need of parts for the Collins R-390A receiver. I especially need two coils (T-501 and Z-503) on the i-f subchassis (the powdered iron tuning slugs in these two coils are cracked). I would appreciate any help in obtaining these parts.

Robert L. Wood WA7DNN
PO Box 9474
Dededo, Guam 96912

I need the schematic, board layout, and alignment data for a Bearcat 101 scanner. Copies from Sam's SD-10 would help. I will reimburse copying costs.

Lisle T. Hines K2QLA
11 Meadow Drive
Homer NY 13077

I have acquired a tube-type model 100 VTVM made by Electronics Design, Inc., of Irvington On Hudson, New York.

I need a service manual, which I will pay for.

George H. Gaul K4FCJ
4904 92nd St. W. Coral Blvd.
Bradenton FL 33507

I need technical or consumer information on a tube-type National radio, model no. HRO-50R, which I am trying to equip with a bfo for single-sideband reception.

Any information will be appreciated.

Angelo Anello
PO Box 15926
Tampa FL 33684

I will pay for copies of the manual and/or schematics for a Central Electronics rf analyzer, model MM-1.

A. L. Marsden WN6AOH
449 North Concourse Avenue
Montebello CA 90640

I am looking for a schematic and service info for the Unimetrics SEA-COM 55 VHF FM marine transceiver. Has anyone converted the rig to 2-meter FM? I will pay copying and postage expenses.

Frank Burkholder K8OBM
702 N. Bryan
Okmulgee OK 74447

I need manuals for an Elco model 147 signal tracer and a Johnson Viking phone patch. I will pay reasonable costs incurred.

Bill Fritache K0SDZ
1512 W. California
St. Paul MN 55109

I need a 4-section electrolytic can capacitor, 20-20-20-30 μF, 650 volts.

Charles Schramm KA2JLC
26-29 35th Street
Long Island City NY 11103

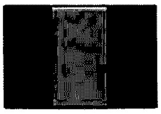
Gertsch FM-9 Service Monitor schematic and/or repair manual needed. Will gladly pay all expenses.

Jim Turgatto WB6ZRO
454 East Cypress Street
Covina CA 91723

73 INTERNATIONAL

Each month, 73 brings you ham-radio news from around the world. In this collection of reports from our foreign correspondents, we present the latest news in DX, contests, and events, as well as keep you abreast of the technical achievements of hams in other countries.

If you would like to contribute to your country's column, write to your country's correspondent or to 73 Magazine, Pine Street, Peterborough NH 03458, USA, Attn: Perry Donham KW1O.



BELGIUM

Michel Bouchez ON6XN
Residence des Agaces 40
7310 Jemappes
Belgium

As I never saw anything from Belgium in "73 International," I take up my pen and hope that you'll be interested by some news from here.

We are about 4,500 hams in Belgium, with about 50% of us active. Calls are designated as follows:

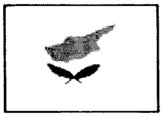
ON0—repeaters
ON1—only VHF and up (non-code exam)
ON4 to ON7—all over the bands
ON8—for foreign hams in HF and VHF
ON9—for foreign only VHF and up

The calls issued were in the form: ON + one number + two letters, but for 2 or 3 years the post office has issued: ON + one number + three letters with the first one from A to J for Flemish hams and K to T for French hams; the old calls are still in use.

There are 3 grades of license, but the call doesn't reflect the grade as in USA. These are class A for input power limited up to 125 W, B1 limited to 250 W in HF and 125 W in VHF, B2 limited to 250 W in both HF and VHF, and C limited to 500 W.

There are a lot of club stations all over the country, but they don't have special calls. These associations receive calls like personal ones. To receive a call, a club must be sponsored by 2 licensed hams who have to guarantee respect of the law. Only licensed hams may work on the station.

There is an official QSL Bureau in Belgium recognized by IARU: It is UBA (Union Belge des Amateurs). On the side there are some small dissident associations which practice what I call a war of QSL cards. Men or women who are not affiliated with one or another association don't receive the QSLs. . . it is really a pity.



CYPRUS

Aris Kaponides 5B4JE
PO Box 1723
Limassol
Cyprus

DX INTERNATIONAL

We were informed recently that ZC4s from the British military bases were given separate DXCC status by the ARRL. There are about a dozen ZC4 stations on the island, and it seems that they are in great demand right now; we get a lot of queries from foreign amateurs about their frequencies and times of operation. I, personally, have a regular sked with ZC4AB, ZC4HA, ZC4JE, and 5B4DN (who is also ZC4AM) on 28.500 MHz at 1800 UTC every Monday, Wednesday, and Saturday. Andy ZC4HA told me that he is usually QRV in CW on 10.103 MHz at night. Alan ZC4AB has no regular times but he is operating usually on 14.275, 21.275, 28.500, and 3.795 MHz. Alan has an excellent V-beam which is directed towards Europe and North America.

ZC4AM (who is also Andy 5B4DN) is operating during the afternoons and evenings when there is propagation on 10, 15, and 20m. Look for him around 14.223. On Saturdays during the daytime he is operating portable from the Salt Lake of Akrotiri with a 4-element half-yagi beam stuck into the soil of the lake with excellent results. Another very active ZC4 is OM Martin ZC4MR, who is operating from the other base (Dhekelia) on the southeast part of the island. I heard him many times on 20m.

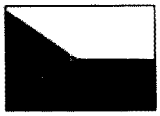
On the 6th and 7th of April, the ZC4s had an activity Easter weekend, operating on all bands for the whole 48-hour period. This was a very good chance for DXers to work the ZC4s.

Now on the 5B4 side, there is good activity on 20m and much less on the other bands. Regulars on 15m and 20m are 5B4OO, 5B4IS, 5B4OP, 5B4IR, 5B4OK, 5B4JE, and 5B4JR. On 40m we have 5B4OK, 5B4JR, 5B4JX, and 5B4JE. On 75m I am QRV most evenings around 2100 to 2200 UTC on 3.795 MHz despite the fact that my FL-2100 B has faulty bandswitch contacts and is not working on 75m. I hope to get a replacement soon from Japan and perhaps my station will be heard a little better.

On 1.8 MHz there is no activity at the moment. On the RTTY mode, 5B4OP, 5B4MD, 5B4MC, 5B4IT, 5B4LP, 5B4HF, and 5B4CV are quite active.

On SSTV, 5B4CV can be found on 14.230 MHz. 5B4JE has receive facilities at the moment but soon he hopes to be on the air on this mode with the assistance of his harmonic, George 5B4OV.

An interesting amateur from Limassol is Andy 5B4IR, who is also the QSL incoming manager of CARS. Andy is an electronics engineer, quite active on the bands, and a good constructor. He is brewing an HF linear at the moment, and together with his FT-902 DM and 3-element tribander is going to be heard for sure.



CZECHOSLOVAKIA

Rudolf Karaba (OK3KFO ARC)
Komenskeho 1477/8
955 01 Topolcany
Czechoslovakia

CHAMPIONSHIP

September 3 to 12, 1984, the Second World Championship in the Radio Orientation Race was held in Kaero, Norway. The representatives from Czechoslovakia gained great success. They won 10 medals: 2 gold, 2 silver, and 6 bronze ones. Eight runners with their coach, Popelik OK1DTW, took part in the championship.

A MODERN RACE

An international contest took place in the capital of the Korean Peoples' Republic in August, 1984. It was held under unusual and almost tropical meteorological conditions. 105 competitors from 6 states participated in it. After four difficult nominating contests, there were 12 competitors chosen with their coach Pazourek OK2BEW and their referee Mikeska OK2BFN. In the race the competitors compete in four events: the reception of telegraphic callsigns, the transmission of callsigns, the operation of the station (1 Watt output), and the orientation race.

EUROPEAN RECORDS

On July 5, 1984, the present European record "Tropo" was broken by propagating in the 433-MHz band, contacting the station GW8VHI in locator YL 32I and the station EA8XS in locator SO 73d. The distance overcome was 2772 kilometers. GW8VHI was using TS-77OE and PA with the input of 50 Watts and a 19-element yagi. QTH is 50 meters above sea level. The station, EA8XS, was working at the mentioned time with: G8ZDS, G4WIQ, EI9Q, and GW8ELR.

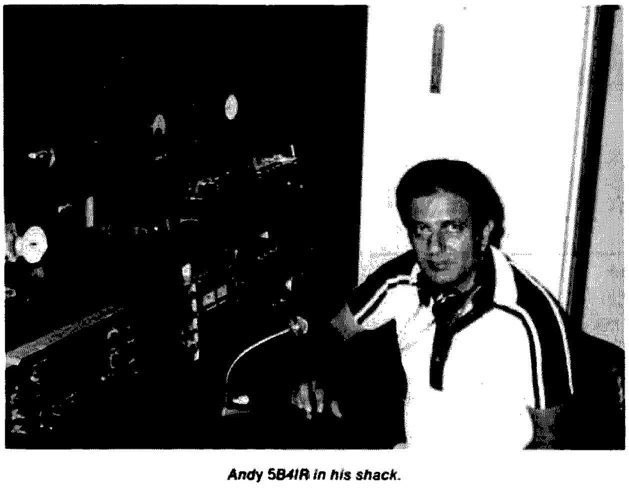
DXPEDITIONS:

In the second half of August, 1984, the first expedition was working in the 1296-MHz band propagating "Earth Moon Earth." It was put into operation by HB9MZQ and OE9PMJ. They were working in Lichtenstein under the callsign HB0BM/P and were using a parabolic antenna. The transmitter used TH-328s for an output of 600 Watts. They were listening to the sun noise at a 13-dB level and made 15 complete contacts with 12 stations in France, Great Britain, Luxembourg, The Netherlands, Czechoslovakia, Sweden, Canada, Australia, and the USA. Radioclub OK1KIR from Prague in Czechoslovakia also made some contacts.

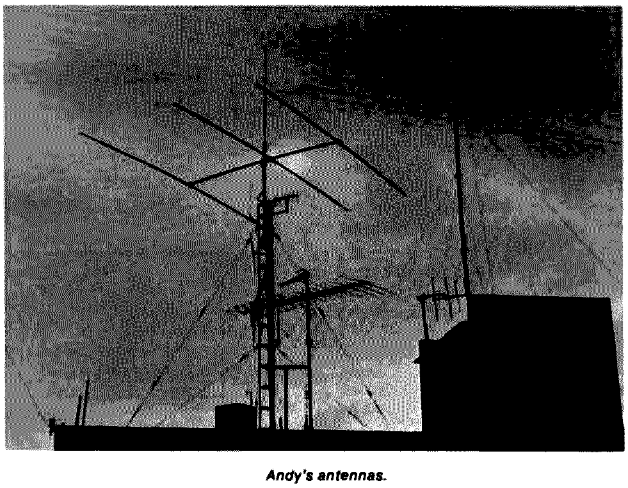
AMSAT-OSCAR 10

OK1BMW and OK1DR had joined their forces and deciphered RTTY transmissions at the GB AO-10 B beacon in the 145.810 MHz band by an "off line" method.

Karel OK1BMW arranged the reception of signals and their recording on tape. It was also necessary to tune up the receiver in such a way so that the tones from the beat-frequency oscillator (bfo) might match those of the low-frequency filter of the teleprinter converter (1275 and 1445 Hz). The oscilloscope attached to the receiver output served for tuning. The frequency of 1275 Hz from the tone generator controlled by a digital counter was brought to the horizontal amplifier of the oscilloscope. The receiver was tuned up in such a way that at the sign signal, on the



Andy 5B4IR in his shack.

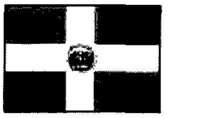


Andy's antennas.

screen an ellipse (Lissayous pattern for the frequency 1:1) appeared. Some hours later Jirka OK1DR, at his teleprinter system with a screen, could read the news from the tape and from memory; he typed with a teleprinter.

DXCC IN CZECHOSLOVAKIA—TOP FIVE STATIONS, (TO 10 OCTOBER, 1984)

CW/Phone		OK1TA	294/300
OK1ADM	315/346	OK1MP	294/297
OK3MM	314/354	OK1MG	290/294
OK1MP	314/345	**Phone:**	
OK2RZ	313/333	OK1ADM	314/340
OK1TA	312/332	OK1MP	312/328
OK3EY	289/293	OK1TA	309/324
CW:		OK2RZ	308/324
OK3JW	296/300	OK2JS	307/317



DOMINICAN REPUBLIC

M. F. Pimentel HI8MFP
Box 2191
Santo Domingo
Dominican Republic, W.I.

Confusion of the name of our country, Dominican Republic, with the island of Dominica is the cause that contributes the most to the loss of correspondence or the QSL cards of HI.

Dominican Republic (HI) is the country that shares the Espanola Island with Haiti (HH). This island, of approximately 76,192 km^2, belongs to the Major Antilles and is located in the Caribbean Sea between Cuba and Puerto Rico.

In the same Caribbean Sea and as part of the Minor Antilles is the Commonwealth of Dominica (J7, VP2D), with an area of 751 km^2. The volume of correspondence that is misled to Dominica, whether addressed right or wrong, is unbelievable.

To avoid this confusion, it is very important to write on the envelope with clear block letters, "Dominican Republic." On other occasions, QSLs and other kinds of correspondence do not have the address clearly written and this, added to a faulty mail system, makes it impossible at times to receive answers and confirmations.

Some days ago, I received a note from a North American ham in which he asked me to help him find a confirmation. The address he had written was "San Pedro Marco" when the correct name of the city is "San Pedro de Marcoris." Another, from New York, wrote underneath the PO Box number: "Santo Domingo, Haiti." Hardly ever does correspondence reach the intended destination if wrong addresses are used—particularly those that are long and complicated. It is better to use PO Box numbers or the QSL Bureau. But—is the Bureau effective?

On certain occasions it is very effective, but sometimes, no! A QSL arrives at the HI Bureau and is processed. If the addressee is up-to-date with his payments, he will rapidly find the QSL in his booth. The QSLs of those with accounts that are past due end up in a common box.

But also to be taken into consideration is that not everyone visits the QSL Bureau regularly to withdraw the correspondence; as a matter of fact, some do not go at all for a long time.

If the contacts are of HI1, 2, 3, or 8, it is effective to use the Bureau or the PO Box number of the station worked. If they are of areas such as 4, 5, 6, 7, and 9, then it is better to send them directly with the address clearly written, keeping in mind the need to always print at the end: DOMINICAN REPUBLIC (or REPUBLICA DOMINICANA) and *not* Dominica or Republic of Dominica.

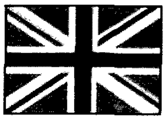
NEW PREFIX

Since the past 3rd of October, commemorating the second visit of Pope Juan Pablo II to the Dominican Republic, a new prefix is on the air. The first stations to receive the new prefix were: HI0DX, HI0MF, and HI0MFP; among others that were later on the air were HI0B and HI0C.

The new prefix will be in force until the next month of March. The QSL address for HI0DX, HI0MF, and HI0MFP is PO Box 2191, Santo Domingo, Dominican Republic. For HI0B and HI0C the address is PO Box 1157 of the Radio Club Dominicano.

NEW BOARD OF DIRECTORS

A new Board of Directors was recently elected for Radio Club Dominicano, presided over by Rosario de Morales HI8RPD, wife of Otto Morales HI8OM, past president of the organization. It is the first time that a woman has been president of the RCD, and she is accompanied by the following: William Read HI8WRE, Vice-President; Otto Morales HI8OM, Secretary; and Victor Taveras HI8VAT, Cesar Desangles HI8CQ, Joe Lomba HI8LE, Abed Nego Montalvo HI8IH, Julio Felix HI9JOF, and Jorge Genao HI9JLG.



GREAT BRITAIN

Jeff Maynard G4EJA
10 Churchfields
Widnes WA8 9RP
Cheshire
England

THE UK SCENE

I can remember in my award-hunting years the difficulty of obtaining details of some overseas awards. One would often see a brief mention in the likes of *73* which was sufficient to whet one's appetite, but insufficient to make an application. Thus followed the double frustration of seeking full details and then waiting for the certificate to arrive.

This particular problem will not exist for the majority of *73* readers (i.e., those living in the US) who are interested in the Worked All Britain (WAB) awards. As well as the Award Manager, G4KSQ (Brian Morris, 22 Burdell Ave., Headington, Oxford OX3 8ED, England), there is a US contact point. Dave Bird AA6DB of 11226 Quinn St., Downey CA 90241, will send a detailed WAB information sheet in return for a stamped and self-addressed envelope.

That such an information sheet is necessary is without doubt when I look at the basis of WAB. The basic award (WAB areas) and the non-UK option (WAB Overseas Introductory Award) both require the award hunter to collect contacts in different map squares. The particular squares are those based on a 10-km × 10-km grid on UK Ordnance Survey (OS) maps. OS maps are the standard by which all maps are judged in the UK and are produced by a quasi-governmental body. However, the 10-km squares are unlikely to be found on maps of the UK available elsewhere (and, if so, are highly unlikely to be numbered in the OS style).

A special record book is available from the award sponsors for $10.00 and can be used to keep track of squares collected. If that's too confusing then try the WAB Counties Award which requires the collection of UK counties only (more like US states than counties). Once again, Dave Bird has the details.

Having extolled the virtues of a local manager for UK awards, I am forced to admit that I do not currently have such for the Cheshire Award which I look after. Any offers?

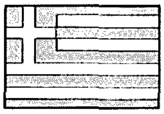
I have briefly explained, in earlier columns, differences between UK licenses. Class A license holders can use all bands whereas Class B can use only 144 MHz and above. The only difference in qualifications is that Class A holders have passed a Morse-code test. So anyone wishing to upgrade from Class B (written examination only) to Class A must learn Morse code.

Unfortunately this has, to date, been an activity confined to the aspirant's house. Class B licenses have not permitted the holder to use Morse even on VHF bands. They could, of course, listen to Morse anywhere for the purpose of practice, but could not transmit.

On April 1st of this year, the Department of Trade and Industry (the DTI—the UK regulatory body) changed this for an experimental period of twelve months. Class B license holders who wish to take advantage of this must request permission in writing and will be given a temporary "license variation." Anyone requesting a variation will be given one. The only direct implication of this for US stations is the potential for more Morse traffic on OSCAR or EME (Class B license holders are not permitted on 50 MHz).

You might, therefore, be able to work a G8 or G6 station on CW. The long-term implication should be more Class A license holders. Any action that promotes amateur radio in this way is to be applauded.

My globetrotting continues (this is being written aboard a Swissair flight to Zurich!) and I am likely to be in New York every five or six weeks. If any reader would like the opportunity to buy me a beer, please write and provide a phone number.



GREECE

Manos Darkadakis SV1IW
Box 23051
Athens 11210
Greece

At the inception of this column, participating countries were few. Today there are many more, and recently I received a note from the magazine saying that from now on columns will be considered on an every-other-month basis. Of course this is fine with me, but it will compress all kinds of information in a new "packed form." I hope the readers will soon be familiarized with it.

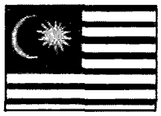
A couple of weeks ago, we had the annual "Cut of the Pie," and taking this opportunity, our union officials honored three of my fellow amateurs for their contribution to amateur radio. The first of them, George SV1AA, is one of those pioneers who for about 50 years now has been supporting all radio activities in this country. The other two, George SV1AB and Costas SV1DH, were honored for a common effort concerning transequatorial propagation. Costas, whose article in *QST* was elected "The Article of the Year" for 1981, has spent many, many hours experimenting and recording the results of his experiments with ZE2JV in Zimbabwe and ZS6PW in South Africa, the stations on the other end of the line.

More on Costas and his experiments in a future column where he will be presented properly.

Finally, I would like also to mention an announcement which was made during this small celebration about an amount of money which was given by the Greek government to our union in order to equip our headquarters. This happened for the first time in our history, and I wish and hope this to be the beginning of a fine cooperation.

One more brief news item: Concerning satellite activity, SV1OE took second place in a contest carried out on AMSAT's AO-10 satellite for a period of three months.

Closing for this month, I note that two Big Guns are coming into Greece for a 160m DXpedition: Bill K1MM and Jim K1MEM should be on by now from the Island of Rhodes; more on this and perhaps some photos in my next column.



MALAYSIA

Mohammed Salleh 9M6MO
No 82, Taman Mesra
Penampang Road
Kota Kinabalu, Sabah
Malaysia

SEANET CONVENTION

The SEANET (Southeast Asia Net) can be heard daily at 1200 UTC, frequency

Speakers at the Symposium (from left): Ebbey 9V1QG, D. D. Devan 9M2DD, Mayuree HS1YL, Hassan V85HG, speaker from Indonesia, and Klaus DK9VC/DU2. (Photo by 9M6MO)

14.320 MHz. This net was started by a few hams in Southeast Asia. It has grown so large that there are checks in from all over the world. Devoted net controllers work out the schedule among themselves, running the net day after day. These controllers pass DX news and emergency or medical traffic, assigning frequencies to stations who wish to contact each other. The desire for net members to have eyeball contact brought about the first convention in 1971, and ever since it has been held annually.

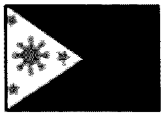
The 14th SEANET Convention was held on the 16th, 17th, and 18th of November, 1984, in Penang Island, Malaysia. One hundred twenty-eight delegates from the Southeast Asian region and also from Japan, Australia, India, and the US attended this convention. Among them there were also beautiful YLs and XYLs. For some of them this was their first time meeting each other. It is amusing to imagine how a person looks like behind a voice and then when you meet him in person to find that your guess was wrong.

Among other interesting things were technical presentations on digital communication, OSCAR 10, and also AMTOR mailbox. During the evening, participants sat and relaxed at the banquet, watching cultural dances presented. Some of the delegates themselves presented their traditional dances, songs, or music.

During the symposium, net members were given the opportunity to voice their suggestions on how to improve the net. Net members were concerned over the growing interference (QRM), especially during net time. The symposium also discussed which country should host the next convention. It was later decided that either Brunei (V85) or the Philippines (DU) will be the host.

Delegates were conducted on a short tour around the Penang Island. Those who were new to the island were able to see many historical and interesting places. For others, who had been here before, this visit brought back some good memories of the past. Among the tourist attractions visited was the snake temple. Visitors can have photographs taken with these snakes coiled around their bodies.

Penang is one of the 13 states of Malaysia. It is situated on the northwestern coast of the peninsula. It consists of the island and a coastal strip on the mainland called Province Wellesley. The island has an area of 285 square km, and Province Wellesley has 759 square km. They are separated by a channel 3 km wide at the closest point. The island and the mainland are linked by a ferry service which operates 'round the clock. A bridge is now being constructed to link up these two places.



PHILIPPINES

Leo M. Almazan WA6LOS/DU2
10098 Knight Drive
San Diego CA 92126

Hello again, everyone. By the time you read this article, I will have gone back to DU-land, just in time for the holiday season.

I was surprised to receive a letter from an old-timer who read my last article and is very interested in going back to the hobby with another old-timer friend who was a former DU ham. They are interested in QSOing with DU hams but are unable to hear any. Since we are currently on the low end of the current sunspot cycle, propagation towards DU-land on 20 meters and 15 meters has not been all that spectacular, although openings on these bands on the west coast have been around 2300Z. One can find Dr. Alex Legarda DU1AL on 14.265 MHz plus or minus QRM (this is the frequency of the informal Mabuhay net which normally meets at 1500Z) or the ever-active Robin DU9RG who is located in the southernmost tip of the Philippines. He normally hangs around 14.230 to 14.170 MHz. There are a dozen class Bs also using the new DV prefix who are active on 15 meters CW and SSB at about 2200 to 2400Z.

Well, as promised in the last article, I will finish the history of amateur radio in the Philippines from WWII to the late sixties.

Most Filipinos heard of the Japanese surprise attack at Pearl Harbor on their radio sets at home. Little did they know that about an hour later they would also be under attack, by another Japanese naval task force. Needless to say, all amateur-radio operations ceased after the invasion. The bands were soon occupied by coded military signals. After the Japanese occupied Manila, all amateur-radio equipment had to be turned in to the Japanese Signal Corps, but some old-timers had told me that they had "saved" enough radio parts to build SW converters for their BC radios and were able to hear broadcasts from station KGEI on 6 MHz. This was their only means of news information other than the Japanese propaganda news on the local radio.

Other local hams also did not lie idle; all of them joined the local resistance and were commissioned to build transmitters and receivers from spare parts stolen from the Japanese. One of these stations was the famous WPM who was shown in the movie "American Guerillas in the Philippines," which starred Tyrone Power. It was shown contacting station KFS in San Francisco—which later became a War Department relay station for the Far East. It was station WPM which later contacted General MacArthur's headquarters in Australia. This was the beginning of the Australia-to-Philippines "connection." At the early stage of the occupation this was the only radio communication station between the headquarters of General MacArthur and the guerilla forces in the Philippines. So amateur radio played an important part in the war effort.

From 1945 to 1946, the postwar era, came a period of transition and adjustment which came about due to the change of the political status of the Philippines from an American colony to an independent nation. It was in this period of transition that an ugly turn of events in Philippine amateur radio came about. As in all parts of the world, postwar meant postwar surplus.

Surplus communication equipment was abundant in Manila and was sold on a big scale, and many sets fell into the hands of unauthorized persons, commercial companies without licenses, and even insurgents who were planning to overthrow the infant Republic. As a reaction to this, the government tightened amateur operations by forbidding third-party communication and DX. DXing was allowed only with the United States and its possessions in Asia and Oceania.

This restriction did the most damage to amateur radio in this country and was not lifted until 1959. Volt Sotto DU7SV was one of the most active hams in the country during this period. His now famous QSL card was one of the most treasured cards from this part of the world

In 1949, the ITU granted the Philippines the DU prefix. Prior to this date many Americans still transmitted from the Philippines. Not until 1949, after the official prefix change, did the Americans actually refrain (of course with a few exceptions) from transmitting from this country. It took till 1977 before Americans could start transmitting again due to the signing of a reciprocal agreement between the two countries.

In the summer of 1959, which coincided with the Boy Scout World Jamboree being held in the country, a major event occurred. During the opening of the Jamboree's amateur-radio station, DU1PAR, the chairman of the Radio Control Board finally granted the ham-radio population the DX privilege to communicate with the countries that sent delegates to the Jamboree. This ended 13 years of restrictive DXing for the local amateurs.

In the sixties, a DXpedition to The Rock (Corregidor) was memorable because it marked the first time since 1949 that American amateurs under the sponsorship of the Philippine Amateur Radio Association were allowed to operate the station in the DXpedition with the new prefix DU0DM. The new prefix attracted DXers, and in the 45 hours of operation in this tiny island bastion, about 300 QSOs and 48 countries were logged.

Well, there it is, a condensed history of amateur radio in the Philippines. Don't forget, if you are passing by the country for a visit or some kind of stopover (even if only at the airport terminal), the PARA repeater frequency is at 144.74, and minus 600 kHz transmit. If you are passing by Clark Air Force Base, the Central Luzon Amateur Radio Club frequency is at 145.70 and there is always somebody monitoring the frequency. So until next time, good DX and good luck.

POLAND

Jerzy Szymczak
78-200 Bialogard
Buczka 2/3
Poland

Communication Publishers has issued the second updated edition of the *Radio Amateur's Handbook*. The work is a useful technical aid for hams, technical school students, and professionals. It reflects the state of radio-amateur techniques in Poland.

In an introductory part of the book, Eng. Andrzej Mickiewicz presents a ham's workshop. Discussing the main stages of radio construction, he acquaints readers with materials and subassemblies, talks over PCBs, coil winding, soldering, and assembly. In subsequent parts of the guide, Eng. Jerzy Kozminski deals with passive or RLC elements, their computations, marking, and technical data.

Different tanks are the subject of a chapter by itself, like wave filters: ladder-types, low-pass, high-pass, RC, and crystal filters. As usual in this book, basic characteristics of available materials are tabulated. Radio noise, disturbance, and ways to stand out against them with suppressor capacitors (of Bosch), coils, and radio interference eliminators (miniatures of Sprague) are mentioned. Diodes, transistors, and some ICs hams attach great importance to are introduced with tabulated parameters and encapsulation drawings.

In the chapter entitled "Basic Circuits," written by Engs. Henryk Chacinski and Andrzej Lobzowski, radio fans find basic theoretical and practical information about different amplifiers, detectors, feeders, and generators. Part and parcel of the modern technique: logics, gates (NOR, NAND, and others), triggers, and counters help to modernize very classical equipment. Basic measuring instruments and their application to radio circuits are presented by Eng. Zbigniew Szpakowski.

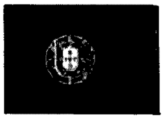
Wireless receiving installations, their subassemblies, remote control, and digital readouts of frequency, panoramic attachments to them, are proficiently described by Engs. Cezary Rudnicki and Leon Kossobudzki.

The largest chapter, "Wireless Transmitting Installations," contains a description of various modulations including SSB, transmitting tubes with their calculations, and other structural members. The author, Eng. Ryszard Janulis, gives some examples of calculation of transistorized line amplifiers for amateur bands 80-0.7, designs of filters for a rectifier of anode voltage, and general ideas of transmitter design. The measurement of SSB signals with an oscilloscope, and harmonics complete the section.

Antennas and propagation are subjects of a chapter authored by Eng. Stanislaw Krolikowski.

More and more popular are remotely-controlled radios, their systems of control, receivers, transmitters, and their operation. They are comprehensively depicted in the 13th chapter by Eng. Andrzej Chmielewski. The last section deals with feed systems. Eng. Zbigniew Szpakowski presents rectifiers, filters, and constant-voltage regulators.

This very useful compendium of radio-amateur knowledge consists of over 1100 pages and many diagrams. No doubt it makes a big contribution to the development of the Polish radio-amateur's service. The printing of 80,000 copies has been sold out.



PORTUGAL

Luiz Miguel de Sousa CT4UE
PO Box 32
S. Joao do Estoril 2765
Portugal

In my last column in this appreciated magazine, I wrote a few notes concerning all the associations and club stations registered in this country. Requesting more information from them, I just received the first report of ARSUL (Associacao de Radioamadores Do Sul), situated in the city of Portimao, southern Portugal.

This place is very well known in the tourism world for the lovely seafood, nice beaches, and the good hospitality of the people, known as "Algarvios." The association was founded March 2, 1982.

According to ARSUL's constitution, the club is for all those who dedicate their efforts to wireless activity and other studies in the electronics field.

ARSUL issues *QSL*, a bulletin sent to all members. In this publication, several matters are discussed such as awards, contests, local news, and small electronic projects—some of them very useful for the hams. In the last issue, we are helped to build the following projects: an antenna coupler for 144/148 MHz, a vfo for 2m, a vertical antenna for 10/15/20 meters, and a

simple but effective semiconductor checker for the bench.

Last November, a contest took place to celebrate the "Feira de Portimao" (Exhibition of Portimao). The contest was organized by this association, and they had a big success, for many Portuguese and Spaniards were enthusiastic for this event. We had CTs, EAs, and EA8s from the Canary Islands.

Here are the point totals for some top scorers:

HF	
CT1BSC	678
EA1CMY	646
EA1CMX	646
CT1CDL	642
CT1YJR	629
VHF	
CT1BSU	128
CT1ASY	118
CT1CPR	99
CT1FQ	97

The boys in ARSUL have a department of software for the users of the ZX Spectrum, Sinclair ZX81, and TS-1000 microcomputers.

ARSUL CW AWARD

The CW operators might be interested in this award, sent to those who accomplished the following:

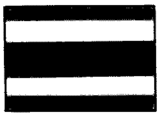
(1) The award is issued to commemorate the anniversary of this association, and the QSOs should be made after March 2 of 1985.

(2) The ARSUL CW Award is available to all licensed radio amateurs and SWLs (allband CW only) who have worked 10 (ten) different CT stations and the ARSUL club station, CT1ARS.

(3) For applying, send a log, copies of QSL cards, and 6 IRCs to ARSUL, PO Box 50, Portimao 8501 Portugal.

IATC NET

This stands for International Air Traffic Control Net. It is rather interesting and is the right place to find people involved in aviation (airline pilots, aircraft engineers, air traffic controllers, balloonists, etc.). I'm sure you all remember the first solo transatlantic balloon flight made by Joe Kittinger, Jr. N4HDP in the *Rosie O'Grady's Balloon of Peace*, in September of 1984, from Caribou, Maine, to Montenotte, Italy. Joe is a member of our net, too. So, if you have any interest in aviation, or even being a good (non-scared) passenger, join us in the future. We meet daily at 1000 UTC on 14,277 kHz. For any other additional information, send your comments to the net controller: Ernie Bracy W1BFA, PO Box 88, Readfield, Maine 04355, USA. Ernie will send you the membership card and an up-to-date list of members. Best 73s from Portugal.



THAILAND

Tony Waltham HS1AMH
c/o Bangkok Post
U Chullang Building
Rama 4 Road
Bangkok 10500
Thailand

Hopes are still high for getting full HF privileges for qualified amateur-radio operators in Thailand, and the most positive remarks in this respect came late last year when Communications Minister Samak Sundharavej told members of the Radio Amateur Society of Thailand (RAST) that he would do his best to legalize amateur radio.

The minister was addressing a gathering of RAST members on the occasion of the 20th anniversary of the founding of the society. On that occasion the minister also spoke on HF and reiterated his pledge to the net control station of SEANET that evening (November 11, 1984), V85GA, in Brunei. (SEANET—Southeast Asia Net meets nightly at 1200Z on 14.320.)

Throughout last year, RAST had strived to work towards full recognition and legalization of amateur radio by the Royal Thai Government. To this end, a dialogue was opened by senior members of the RAST committee with top-ranking Post and Telegraph Department officials. This included an informal discussion with Director General of the PTT, Mr. Mahidol Chantrangkoon. This dialogue is continuing, and further talks have been conducted in early 1985, all ending on a positive note.

The main holdup now would seem to be for the authorities to establish the necessary qualifications for operators, the allocation of specific radio spectrum, and a clearance from the National Security Council, the top government watchdog under the Office of the Prime Minister.

In other respects, RAST has maintained Thailand's international standing by applying for, and receiving, permission from the PTT to operate during major amateur-radio contests. This is an ongoing activity, and RAST recently sent an appeal to several DX magazines for dates of major contests so that the society can get its application for permission to operate in good time.

Contest operations last year enabled many radio amateurs throughout the world to establish a contact with radio amateurs in Thailand as well as to demonstrate to the IARU and other regulatory bodies that amateur radio is still very much alive in Thailand, albeit at the moment somewhat restricted. In order to achieve this, club members worked to set up the club's own HF station located at the Asian Institute of Technology campus at Rangsit, 45 km north of Bangkok.

One significant operation followed an approach by the Japan UNICEF Ham Club to operate here for three days on behalf of the Fund. In this operation alone, operating with the special callsign HSØJUA, over 3,000 contacts were made. A similar operation in 1983 raised over US$500,000 for the Fund. Figures for the entirely-voluntary donations being made following last year's (1984) operation in July are yet to be finalized.

Other major contests include the European DX Contest, the SEANET Contest, and the *CQ* Worldwide Contest when HSØA was active on all HF bands.

A special station was also set up at the venue for the 20th anniversary celebrations of RAST where many visiting non-hams were able to witness for the first time a two-way contact with other radio amateurs thousands of miles away, using both Morse code and phone.

The club station was active during the following contests: As HSØA—SEANET DX Contest (phone), August 21-22; European DX Contest (phone), September 8-10; *CQ* Worldwide Contest (phone) October 27-28; RAST anniversary celebrations on November 11 at Hyatt Central Plaza Hotel, and as HSØJUA for UNICEF, July 27-30. (QSL cards to the Bureau address, G.P.O. Box 2008, Bangkok 10501 Thailand.)

International standing was also maintained by corresponding with the IARU, the ARRL, and other major amateur-radio societies, informing them of our activities and updating such publications as the international edition of the *Callbook*.

In addition, extensive information on amateur-radio activities in 15 countries in the region was supplied to the Post and Telegraph Department. Much of this was gleaned from helpful articles in "*73 International*," and credit, of course, has been given in the text in the form of references.

For amateur-radio operators in countries where licensing is automatic upon proving the necessary skills and experience, the issue of conveying the importance of amateur radio—in self-training, in emergency communications and other aspects of the service—is perhaps overlooked. Yet many countries the world over restrict amateur radio, if they do not ban it altogether. It would seem to benefit more than mere DXers if members of some kind of action group would cull out all the best examples where amateur radio has rendered an invaluable service, or helped in training an acknowledged expert who admits that without an interest in amateur radio he would never have made whatever breakthrough he achieved in the field of electronics.

Thailand is surrounded by countries where amateur radio is dormant. Burma, Laos, and Cambodia, for different reasons, remain silent. Not much further afield Bangladesh and Vietnam also offer silent testimony to a stifled hobby. Any means to help promote this hobby would surely be in everyone's interest. Both Burma and Bangladesh have national radio societies, while other countries which oppose the hobby generally have resident radio amateurs working in embassies or as expatriates. All would benefit from a central "data base" or committed group. RAST committee members, meanwhile, have been doing their best to convince the authorities of the benefits to be derived from the service.

During the society's annual general meeting held in December, 1984, Khun Chamnong Bhirom Bhakdi HS1WB was reelected President of RAST. First Vice-President is Yongyuth Napasap HS1DS; Second Vice-President is Mrs. Mayuree Chotikul HS1YL; Secretary-General is Hans Hollstein HS1BG, and the Treasurer is Rasdaporn Boonpitak HS1DC.

A rendezvous in Portugal. From left to right: PY4LF, CT4UE, CT1BON, ZS1XP, and CT1AXY.

Spreading the word. Tony HS1AMH at the mike during the 20th anniversary celebrations of the Radio Amateur Society of Thailand. The large number of bystanders is testimony to the fascination and interest that the hobby generates. Seated next to Tony is Eddy HS1ALP.

DEALER DIRECTORY

Culver City CA

Jun's Electronics, 3919 Sepulveda Blvd., Culver City CA 90230, 390-8003. Trades 463-1886 San Diego, 827-5732 (Reno NV).

Fontana CA

Complete lines ICOM, DenTron, Ten-Tec, Mirage, Cubic, Lunar, over 4000 electronic products for hobbyist, technician, experimenter. Also CB radio, land-mobile. **Fontana Electronics, 8628 Sierra Ave., Fontana CA 92335, 822-7710.**

San Jose CA

Bay area's newest amateur radio store. New & used amateur radio sales & service. We feature Kenwood, ICOM, Azden, Yaesu, Ten-Tec, Santec & many more. **Shaver Radio, Inc., 1775A S. Winchester Blvd., Campbell CA 95008, 370-6665.**

New Castle DE

Factory Authorized Dealer! Yaesu, ICOM, Ten-Tec, KDK, Kenwood, AEA, Kantronics, Santec. Full line of accessories. No sales tax in Delaware. One mile off I-95. **Delaware Amateur Supply, 71 Meadow Road, New Castle DE 19720, 328-7728.**

Preston ID

Ross WB7BYZ has the largest stock of amateur gear in the Intermountain West and the best prices. Call me for all your ham needs. **Ross Distributing, 78 So. State, Preston ID 83263, 852-0830.**

Littleton MA

The reliable ham store serving NE. Full line of ICOM & Kenwood. Yaesu HTs, Drake, Daiwa, B&W accessories. Curtis & Trac keyers. Larsen, Hustler, Telex/Hy-Gain products. Mirage amps., Astron P.S., Alpha Delta protectors, ARRL & Kantronics instruction aids. Whistler radar detectors. Full line of coax fittings. **TEL—COM Electronic Communications, 675 Great Rd. (Rt. 119), Littleton MA 01460, 486-3400/3040.**

Derry NH

Serving the ham community with new and used equipment. We stock and service most major lines: AEA, Astron, Azden, B&W, Cushcraft, Hy-Gain, Hustler, ICOM, Kenwood, KLM, Larsen, Mirage, Mosley; books, rotors, cable and connectors, Business hours 9-7 Monday through Thursday, and 9-5 Friday and Saturday. **Rivendell Electronics, 8 Londonderry Road, Derry NH 03038; 434-5371.**

Albany, New York
UPSTATE NEW YORK

Kenwood, ICOM, Ten-Tec, Belden, Cushcraft, Larsen, Hustler, ARRL, Hy-Gain, B&W, MFJ, Mirage. New and used equipment. Serving the amateur community since 1942. **Adirondack Electronics, Inc., 1991 Central Avenue, Albany NY 12205, 456-0203** (one mile west of Northway exit 2W).

Columbus OH

The biggest and best ham store in the Midwest featuring Kenwood and other quality products with working displays. We sell only the best. Authorized Kenwood service. **Universal Amateur Radio, Inc., 1280 Aida Dr., Reynoldsburg (Columbus) OH 43068, 866-4267.**

DEALERS

Your company name and message can contain up to 25 words for as little as $150 yearly (prepaid), or $15 per month (prepaid quarterly). No mention of mail-order business or area code permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the September '85 issue must be in our hands by July 1st. Mail to 73 Magazine, Peterborough NH 03458. ATTN: Nancy Ciampa.

PROPAGATION

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA						20	20					
ARGENTINA	20	20	20	40			20	20	15	15	15	15
AUSTRALIA		20	20	20	40	40	20					
CANAL ZONE	15	40	40	40	40[1]	40		15	15	15	10	10
ENGLAND			40[1]	40			20	20	20	20	20	20
HAWAII			20		40		20					
INDIA												
JAPAN						20	20					
MEXICO	15	40	40	40	40[1]	40		15	15	15	10	10
PHILIPPINES							20					
PUERTO RICO	15	40	40	40	40[1]	40		15	15	15	10	10
SOUTH AFRICA			40	40		20	20				20	
U.S.S.R.							20	20		20		
WEST COAST	20	40	40	40[1]	40[1]	40						20

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA		20	20					20	20			
ARGENTINA	15	20	20	40			20	20		15	15	15
AUSTRALIA	15	20	20	20	40[1]	40		20			20	
CANAL ZONE	15	20	20	20	40[1]	40	20	20	15	15	15*	10
ENGLAND	20	40					20	20		20	20	20*
HAWAII	15	15	20	20	20	40	20	20				
INDIA												
JAPAN		20	20					20	20			
MEXICO	15	20	20	20	40[1]	40	20	20	15	15	15*	10
PHILIPPINES		20	20				20	20				
PUERTO RICO	15	20	20	20	40[1]	40	20	20	15	15	15*	10
SOUTH AFRICA							20				20	20
U.S.S.R.								20			20	

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA		20	20						20			
ARGENTINA	15	20	20	40	40			20	20		15	15
AUSTRALIA		20	20	20	20	40[1]	40[1]		20		15	15
CANAL ZONE	15	15	20	20[1]	40[1]	40		20	20	15	15	15
ENGLAND	20							20	20			20
HAWAII	20	15	15	20	20	20[1]	40[1]	40	20		20	20
INDIA				20					20			
JAPAN		20	20						20			
MEXICO	15	15	20	20[1]	40[1]	40		20	20	15	15	15
PHILIPPINES				20					20			
PUERTO RICO	15	15	20	20[1]	40[1]	40		20	20	15	15	15
SOUTH AFRICA			40						20			
U.S.S.R.									20			
EAST COAST	20	40	40	40[1]	40[1]	40						20

1 = Possible 80-meter openings.
*** = Check next higher band.**

G = Good, F = Fair, P = Poor.

JUNE

SUN	MON	TUE	WED	THU	FRI	SAT
						1 F-P
2 F	3 F	4 F-P	5 F-G	6 G	7 G-F	8 F
9 G	10 G	11 F	12 F-G	13 F	14 P	15 P
16 F	17 P	18 P	19 F	20 F	21 F-G	22 G
23 G / 30 G	24 G	25 F-P	26 P	27 F	28 G	29 G

OUR 25th ANNIVERSARY YEAR!

July 1985
$2.50 USA
$3.50 Canada

73 for Radio Amateurs

A CWC/P Publication

International Edi

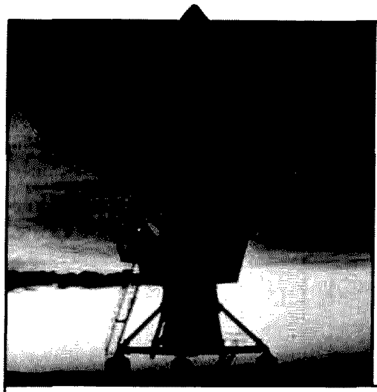
The World's Greatest Array?

SUPER-SCAN THE TS-930S!

FLASH! 24 Megs Is Ours!

Project of the Month: Your Own WARC Receiver

DAYTON FACES '85



73 for Radio Amateurs®

ISSUE #298 JULY 1985

On the Cover:
Sunrise at New Mexico's Very Large Array. Photo courtesy of the National Radio Astronomy Observatory.

4 **What?**
7 **QRX**
60 **Barter 'N' Buy**
61 **Special Events**
64, 92 **Ham Help**
65 **DX**
66 **Be My Guest**
67 **Fun!**
67 **Satellites**
68 **New Products**
78 **Review**
79 **RTTY Loop**
80 **Contests**
87 **Letters**
88 ***73* International**
94 **Dealer Directory**
94 **Propagation**
95 **List of Advertisers**

8 **Faces of Dayton '85**
. . . . KW1O, WB8BTH

12 **ICOM's Extended Play**
Ten minutes with a Phillips screwdriver gives your IC-751 transmit capability from .1 to 30 MHz! KS4B

18 **America's Dream Array**
Twenty-seven dishes in a twenty-one-mile pattern make for some *serious* DXing at the National Radio Astronomy Observatory. Galactic DXCC, anyone?
. . . . AJØN

22 **WARC for the FT-101E**
Here's how to join the fun on our new 12-meter band. And you'll be ready for 18 MHz, too! ZS2RH

24 **The Dayton Downlink**
Optimizing your OSCAR downlink system can be frustrating. Use this easy method to measure your improvements and know just when to stop. W9JD/8

30 **The 30-Meter-Plus Receiver**
Explore the world of 10 MHz with a solid-state receiver you've built yourself! We've come a long way since oatmeal boxes and cats' whiskers. N4EY

34 **The Incredible Inducto-Gauge**
Measure coils with impunity! Better yet, measure them with this weekend project: a do-it-yourself inductance meter. . . . . Ketchledge

38 **The Peerless Power Pack**
Simplicity is the key to this rugged 12-volt, 5-Amp supply. If you're looking for quick energy, here's the answer. KO2G

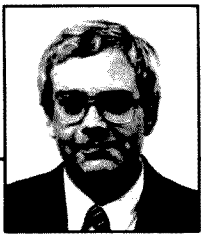
40 **What You See Is Where You're At**
Tired of guessing your frequency? Resolve your problem to 100 Hz with this add-on digital display. WA8YKN

44 **There and Back Again**
Add band-scanning to your TS-930S for under $20. . . . . KC7O

50 **Home-Brew the Blockbuster**
In a heroic effort, WB2WIK has created the ultimate 6-meter amplifier. Its single 4-1000A delivers over 2 kW with only 20 Watts in. The power supply *alone* weighs 120 pounds. When this monster talks, people listen! WB2WIK

56 **Broken Ox Blues**
The grid-dip oscillator is a stellar performer, but missing coils can mean big headaches. Avoid frustration by winding your own. W7RXV

Editorial Offices: Pine Street, Peterborough NH 03458, phone: 603-924-9471 **Advertising Offices:** Elm Street, Peterborough NH 03458, phone 603-924-7138 **Circulation Offices:** Elm Street, Peterborough NH 03458, phone: 603-924-9471 **Manuscripts:** Contributions in the form of manuscripts with drawings and/or photographs are welcome and will be considered for possible publication. We can assume no responsibility for loss or damage to any material. Please enclose a stamped, self-addressed envelope with each submission. Payment for the use of any unsolicited material will be made upon acceptance. All contributions should be directed to the *73* editorial offices. "How to Write for *73*" guidelines are available upon request. US citizens must include their social security number with submitted manuscripts. **Subscription Information:** Rates: in the United States and Possessions: One Year (12 issues) $24.97; Two Years (24 issues) $38.00; Three Years (36 issues) $53.00. Elsewhere: Canada and Mexico—$27.97/1 year only, U.S. funds. Foreign surface mail—$44.97/1 year only, U.S. funds drawn on U.S. bank. Foreign air mail—please inquire. To subscribe, renew or change an address: Write to Subscription Department, PO Box 931, Farmingdale NY 11737. Send Canadian changes of address to: 73, PO Box 1051, Fort Erie, Ontario CANADA L2A 5N8. Return postage guaranteed. For renewals and changes of address, include the address label from your most recent issue of *73*. For gift subscriptions, include your name and address as well as those of gift recipients. For questions concerning your subscription and to place subscription orders, please call us toll free at 1-800-645-9559 between 9 am and 5 pm or write to *73*, Subscription Department, PO Box 931, Farmingdale NY 11737. *73 for Radio Amateurs* (ISSN 0745-080X) is published monthly by CW Communications/Peterborough, Inc., 80 Pine Street, Peterborough NH 03458. Second class postage paid at Peterborough NH 03458 and at additional mailing offices. Canadian second class mail registration number 9566. Microfilm Edition—University Microfilm, Ann Arbor MI 48106. Postmaster: Send address changes to *73*, Subscription Services, PO Box 931, Farmingdale NY 11737. Nationally distributed by International Circulation Distributors.



WHAT? News from the Publisher

People have called and written with regard to the last person we contacted in our February telephone survey: the pickle-trucker from Washington State who turned out to be a Novice. What they want to know is who was the *first* person we contacted. Hello, E.

I made the first of our hundred calls to an OM on an island on the east coast. As bad luck would have it, he's a Silent Key—one of three whose calls we happened to select at random. E is his XYL. She was really nice and felt really honored to be called, I think, but she certainly was adamant: "I want to do the survey for him." I'm sorry, you really can't. "I took down his aerial myself." I know, but our survey wouldn't be accurate if you were the one who answered. "You're right." And then she said this: "Would you tell hams that they mean a lot to me?" I said I'd try.

KA8UET and W8IZF were adamant, too—at the Dayton Hamvention. "We've tried to talk to other people, but they won't listen." I promised them that their views would at least be *seen* in *73*. They want more articles about QRP rigs in all publications, they want VEs of any class to be able to administer tests for their own license level or lower, and they think that a small part of 160 might be a good place to try Novice phone. There! Let it never be said that we don't hear our readers. Speaking of which, we talk with our readers, too, on a regular basis. If you're a letter-writer, complimentary or critical, you might get a landline call from me. Hello, Snohomish, for example.

Dayton was alluring and addictive, as usual. It was a friendly frenzy. How can I describe to those of you who weren't there what it's like to see 24,000 people running around with beady eyes for three days trying to figure out what to buy next? I don't know what to say about DARA, either. Is the Dayton Amateur Radio Association efficient? Sure. The best club in the US? Maybe. Best in the world? Possibly. Able to cope with 30,000 next year? We will see. Don't bet against it.

Do bet on me saying something I meant to last year but didn't: Thank you, everyone I've met in the Dayton area, for being so cordial and courteous and helpful. You go out of your way. I saw somebody from out of town see one of your red, white, and blue trash bins and say, "Hey, an All-American city!" He was surprised. I wasn't. Thanks again.

Thanks, too, to Don Wallace W6AM. I tried to think of some sort of obituary-type key-is-silent thing to write to let you know that he passed away on May 25th. I couldn't. If you, like me, were one of the scores of thousands of people who had the honor of speaking with Don, I hope you'll agree that "thanks" says it all. There are many great amateurs now and there'll be many more in the future, but there'll never be another "Superham."

Jack Burnett

73 for Radio Amateurs is a member of the CW Communications/Inc. group, the world's largest publisher of computer-related information. The group publishes 57 computer publications in more than 20 major countries. Nine million people read one or more of the group's publications each month. Members of the group include: Argentina's *Computerworld/Argentina;* Asia's *The Asian Computerworld;* Australia's *Computerworld Australia, Australian PC World, Macworld* and *Directories;* Brazil's *DataNews* and *MicroMundo;* China's *China Computerworld;* Denmark's *Computerworld/Danmark, PC World* and *RUN* (Commodore); Finland's *Mikro;* France's *Le Monde Informatique, Golden* (Apple), *OPC* (IBM) and *Distributique;* Germany's *Computerwoche, Microcomputerwelt, PC Welt, SoftwareMarkt, CW Edition/Seminar, Computer Business, RUN* and *Apple's;* Italy's *Computerworld Italia* and *PC Magazine;* Japan's *Computerworld Japan;* Mexico's *Computerworld/Mexico* and *CompuMundo;* The Netherland's *Computerworld Benelux* and *PC World Benelux;* Norway's *Computerworld Norge, PC World* and *RUN* (Commodore); Saudi Arabia's *Saudi Computerworld;* Spain's *Computerworld Espana, Microsistemas/PC World, Commodore World;* Sweden's *ComputerSweden, Mikrodatorn* and *Svenska PC;* the UK's *Computer Management, Computer News, PC Business World* and *Computer Business Europe;* Venezuela's *Computerworld Venezuela;* the US's *Computerworld, Hot CoCo, inCider, Infoworld, MacWorld, Micro Marketworld, PC World, RUN, 73, 80 Micro, Focus Publications* and *On Communications.*

QRX...

EDITED BY PERRY DONHAM KW1O

Band New!

A NEW AMATEUR BAND opens for business on June 22, 1985, at 0001 UTC! The FCC has decided to allow hams early access to the 12-meter spectrum allocated during the last World Administrative Radio Conference. General-, Advanced-, and Extra-class ticket-holders may use 1500 Watts PEP from 24.890 to 24.990 MHz on a shared basis with Fixed Service users until July 1, 1989, when the band will become exclusively ours. Because of an existing IARU Region 2 resolution, the FCC has opted to specify formal subbands: 24.890 to 24.930 MHz is available for A1A and F1B emissions, and 24.930 to 24.990 MHz is available for A1A, F3E, G3E, A3C, A3F, F3C, and F3F. There are about 40 countries allowing hams to use this band right now. See you on 12!

160 Grows Up

THE FCC SMILED on amateurs in another area concerning the use of RTTY, FAX, and SSTV on 160 meters. Effective June 17, 1985, hams may use these modes on the entire band. In their final ruling on Docket 84-959, the Commission stated that "the present limitation restricting emission modes... is no longer necessary since that limitation was designed to protect the discontinued LORAN-A radionavigation system." However, the ruling also stresses that Docket 84-874, which addresses amateur use of 1900–2000 kHz, is still in motion, and that "no equities will accrue for investment in equipment which operates only in this band."

Arizona Splits

ARIZONA HAS ADOPTED the 20-kHz-split repeater band plan for 2 meters. No new 15-kHz-split requests will be coordinated, but new 20-kHz pairs will be assigned only when a written agreement is obtained from all of the repeaters that would be required to move. State coordinators are taking things slowly and the entire process is entirely voluntary.

RFI Battle

A CANADIAN AMATEUR is being sued for damages in a $35,000 RFI case. A neighbor of Jack Ravenscroft VE3SD claims that his microwave oven turns on and that his electronic organ's sound deteriorates whenever Jack fires up on 20 meters. There is a very real chance that an unsympathetic judge could rule in the plaintiff's favor, setting an ugly precedent for interference cases everywhere. The Ottawa Amateur Radio Club has set up the Jack Ravenscroft Defense Fund; if you would like to contribute to the cause, conatct OARC at Box 8873, Ottawa, Ontario K1G 3J2.

Happy Hams

THREE LUCKY PEOPLE are very glad that they stopped by the *73* booth at the Dayton Hamvention this year. Not only did they get to meet the wonderful folks who bring you *73* every month, they were winners in our special Dayton HT Giveaway! Ken Hydeman K8SVM of Dayton, Ohio, won a Yaesu FT-209RH, Jean Gade from Hot Springs, Arkansas, received a Kenwood TH-21AT, and Don Cogley KA0CPY of Omaha, Nebraska, walked away with an ICOM IC-02AT. Turn to the next page to see some of the thousands of sad people who *didn't* win a hand-held at Dayton.

October 'Fest

TWO GERMAN ASTRONAUTS will be carrying amateur radio aboard a Shuttle flight scheduled for October of this year. Dr. Ernst Messerschmid DG2KM and Dr. Reinhard Furrer DD6CF will be on board *Columbia* this fall during the first German-controlled Spacelab mission. The equipment, built by the Robert Bosch Company, provides four 2-meter receive channels and eight 70-cm 10-Watt transmit channels. Plans call for FM two-way QSOs whenever possible, and automatic recording of calls when Ernst and Reinhard are busy with flight-related duties. A 1-Watt 70-cm beacon will come in handy for determining if the Shuttle is in range of your station. "QRX" and the *73* RBBS at (603)-924-9809 will carry complete details of the operation, including frequencies, when they are announced.

The astronauts of Spacelab mission D1 (from left): Wubbo Ockels, Reinhard Furrer DD6CF, Ulf Merbold, and Ernst Messerschmid DG2KM.

Marti Me

AFTER A DELAY OF A YEAR AND A HALF, Radio Marti will begin operation with 14½ hours of Cuban programming each day. Part of the Voice of America, the Florida-based station will transmit news and entertainment to Cuba on the standard AM broadcast band, perhaps inviting retaliation by Cuban-based high-power jamming equipment. It would make 1150 kHz sound like 40 meters at night!

Shuttle Shot

THE LATEST WORD FROM NASA has Shuttle mission 51-F carrying Tony England W0ORE and John-David Bartoe W4NYZ lifting off on July 15th. Amateur operation during the first few days will consist of unattended SSTV on 145.55 MHz using a modified Robot 1200C scan converter. Rick Sammis of Robot Research says that the modifications include the Shuttle's mission logo stored in ROM and an automatic sequencer that will transmit frames using most of the popular slow-scan formats. The third day should bring opportunities for two-way QSOs, but most of the activity will occur on unannounced frequencies during scheduled contacts with clubs and youth groups. NASA has agreed to announce the status of the ham station at least one pass in advance: Listen for Shuttle ground communications that will be retransmitted by Goddard club station WA3NAN on 3.860, 7.185, and 14.295 MHz during the astronauts' activity period.

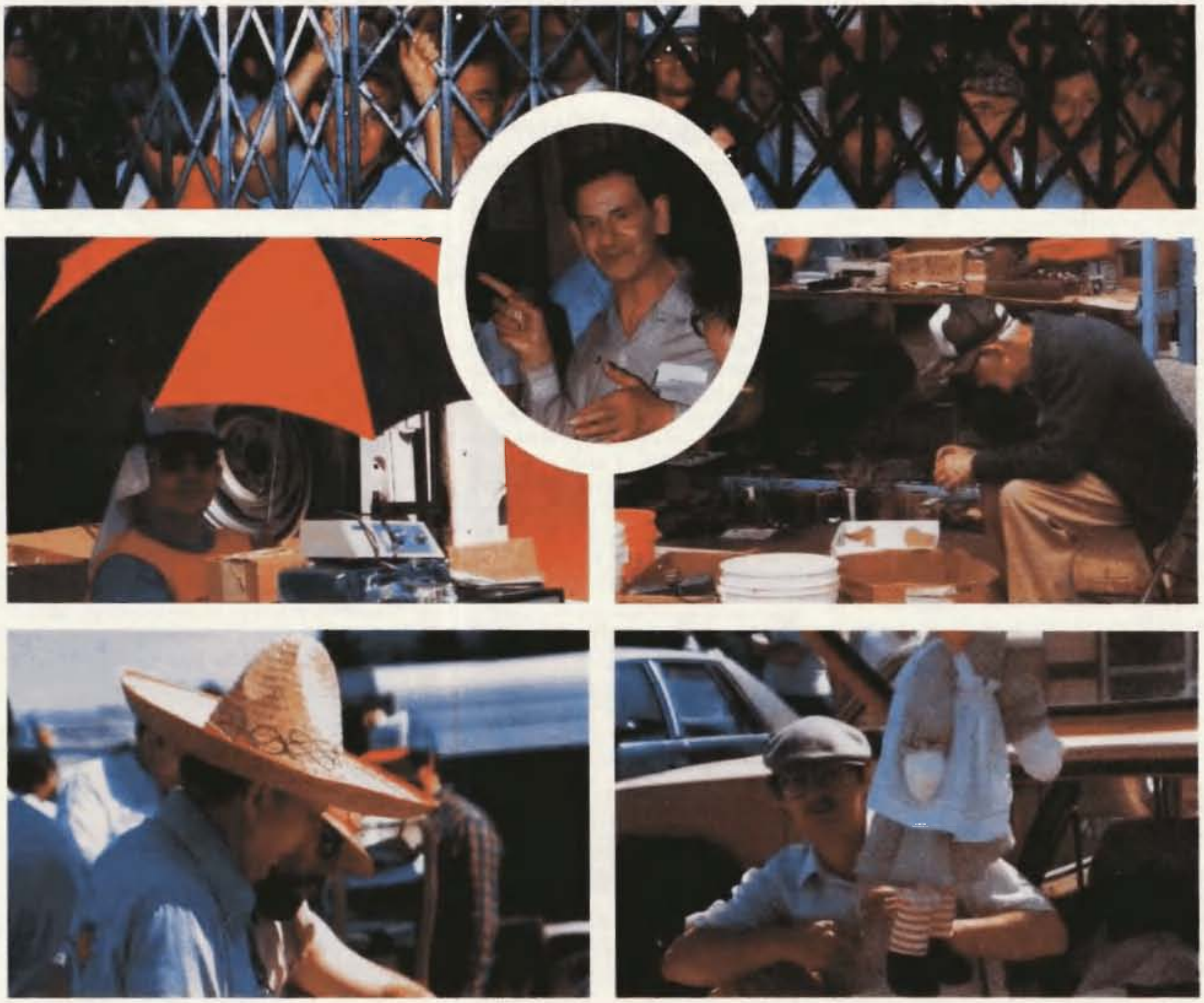
Hot Spot

YOU CAN ALWAYS TELL when warm weather arrives in New Hampshire—with it come visitors to *73*! Recent guests included Jim KF4OO and his wife Nancy, who were up from Florida on a tour of the east coast. We always enjoy meeting the people who read the magazine; if you happen to be in Peterborough, be sure to drop by and say hello.

Merci

WE TIP OUR HAT this month to *The ARRL Letter*, the *W5YI Report*, the *CRRL News*, Ralf Beyer DJ3NW, and Paul Courson WA3VJB, all of whom contributed to "QRX" this month.

Faces of Dayton '85





Radio








John S. Wilcox KS4B
640 Breton Bay Drive
Leonardtown MD 20650

ICOM's Extended Play

Ten minutes with a Phillips screwdriver gives your IC-751 transmit capability from .1 to 30 MHz!

In its short lifetime, the ICOM IC-751 competition-grade HF transceiver has truly become a standard of comparison. The excellent quad-conversion receiver coupled with the most up-to-date digital features has made it the transceiver to be reckoned with.

One of the features that enhances the IC-751 and makes it a superlative bargain for maritime, commercial, and MARS operators is the all-mode general-coverage capability. This feature allows AM, FM, CW, RTTY, and SSB reception from 100 kHz to 30 MHz—all standard. The transceiver is supplied with transmit capability limited to the nine WARC amateur bands but can be modified easily to transmit virtually throughout the spectrum. This simple modification requires the removal of one pin from a plug on the rf printed circuit board and is immediately reversible with no soldering required. With only a Phillips screwdriver needed as a tool for this modification, it's pretty hard to beat!

Remove the top cover of the IC-751. Twelve Phillips-head screws retain this cover. (It would be smart at this point, if you haven't already, to disconnect the power from the transceiver.) Locate J2 on the rf PCB (see Fig. 1). Note the bottom-most pin (pin 1) on the plug. This is the mute-signal line and is the one you'll be removing. On my transceiver, the wire color to this pin is black.

Carefully work the plug out of J2 and turn it so that the small access holes in the side of the plug are visible to you (see Fig. 2). Insert a small pointed tool or pin into the access hole for pin 1 and depress the pin retainer. Grip the wire and carefully pull the pin back out of the plug. Align and reinsert the plug into J2. Tape the loose pin and dress the wire so it can't be pinched when the top cover is replaced. Make sure that no other wires or cables have moved out of place on the rf board or on the top main board so that they could be pinched. This action might save you numerous hours of heartache while your brand-new IC-751 is in Bellevue, Washington, getting repaired!

Following the modification, all functions remain the same when operating the transceiver. Notice that the general-coverage (GENE) readout still lights in the display window when that mode is energized. The only difference is that now you are able to transmit anywhere—in or out of the amateur bands. The GENE flag must now be looked upon as a warning indicator to save you more heartache from the pink slip you could get for transmitting out of authorized bands.

For the squeamish or more forgetful hams who want the full transmit capability but not the responsibility of transmitting where they shouldn't, the mute line can easily be wired to two spare pins on the back-panel accessory socket and a temporary jumper placed across the socket pins. Pins 14 through 24 of the accessory socket are available for this purpose.

This simple change makes ICOM's best even better. Normal maritime, commercial, and MARS operation is now possible as is the peace of mind you gain by having full HF transceive capability for possible emergency communication conditions. ICOM can be congratulated for providing a real thoroughbred to the communications world. ■

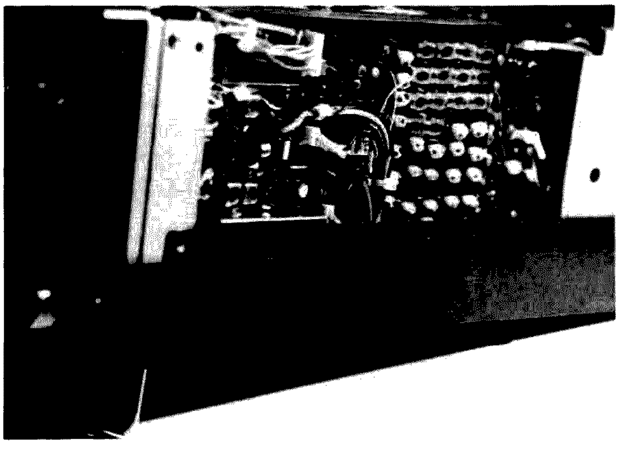


Fig. 1. Arrow points to the connector.

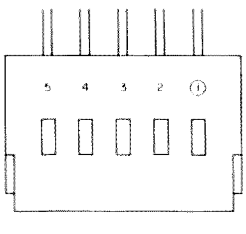


Fig. 2.

America's Dream Array

Twenty-seven dishes in a twenty-one-mile pattern makes for some serious DXing at the National Radio Astronomy Observatory. Galactic DXCC, anyone?

Roald Steen AJ0N
6217 Ridge Drive
Woodbury MN 55125

The Very Large Array in New Mexico is the world's most advanced radio astronomy observatory. This observatory, which looks like a huge Y when seen from the air, is located near Socorro on the Plains of St. Augustin. Along the outline of the Y, 27 large reflecting antennas can be seen in a pattern which may change from week to week.

The VLA (Very Large Array) radio observatory was constructed by the National Radio Astronomy Observatory (NRAO). NRAO, which is funded by the National Science Foundation, is also responsible for the daily operation of the Very Large Array.

NRAO was formed in 1956 to develop the best possible radio telescopes and to make these available to scientists from all countries. The first NRAO observatory was constructed near Green Bank in West Virginia, a site which was chosen because nearby mountains shield the observatory from most types of man-made radio noise. NRAO also constructed a millimeter-wave radio observatory at the top of Kitt Peak in Arizona. Millimeter radio waves are attenuated by the atmosphere, so this observatory had to be located at a high altitude to reduce the problem of atmospheric attenuation.

The St. Augustin Plains in New Mexico were selected by the NRAO as the site for its most advanced observatory for several reasons. The area is sparsely populated,

Photos: the National Radio Astronomy Observatory, operated by Associated Universities, Inc., under contract with the National Science Foundation.

The galactic center of the Milky Way. The powerful radio sources in this VLA image may be caused by a huge black hole.

Technician inspecting the receivers and feedhorns on a VLA antenna.

Most of the observations from the VLA are processed into radio images or maps. The color graphics are produced by VLA computers. Colors are used to depict varying intensities in the radio images.

Installation of a VLA waveguide. These two-inch copper tubes serve as two-way communication channels. Control signals flow from the control building to the antennas in one direction, and the data from the observations flow in the opposite direction.

and there is little nearby industry, so that little man-made radio noise could interfere with the observatory. The plains are extremely level, so the railroad-type rails which are used to transport the antennas from one location to another could follow straight lines across the facility. Reception of radio waves on the shortest wavelengths which the observatory can use is subject to atmospheric attenuation. As the St. Augustin Plains are located at an altitude of about 7000 feet above sea level, the atmospheric attenuation is low.

The electromagnetic spectrum ranges from the extremely short gamma rays to long radio waves. All parts of this spectrum are of interest to astronomers. Only visible light, radio waves, and portions of the ultraviolet and infrared wavelengths can be observed from the ground as the atmosphere shields us from the rest of the electromagnetic spectrum.

The resolution which a telescope can give of a distant object depends upon the wavelength through which the telescope is observing that object and the diameter of the telescope. Because radio waves are much longer than the waves of visible light, a radio telescope must be much larger than an optical telescope to achieve the same ability to resolve distant objects. A radio telescope would have to be several miles in diameter in order to equal the largest optical telescopes in their ability to show fine details in an object.

During the 1950s, astronomers in England and the United States developed a more practical way to improve the resolution of radio telescopes. This method is called interferometry. Through interferometry, two or more radio telescopes are combined in observing the same object. With this technology, a resolution may be achieved which would approach that of a single telescope whose diameter is equal to the distance between the combined radio telescopes. Interferometry requires extremely accurate clocks which are used to measure the time of arrival of a signal at each of the two or more radio telescopes that are participating in an observation.

The VLA was completed in 1980 after seven years of construction. There are 27 identical parabolic reflector antennas in the array. The antennas are mounted on foundations that are movable along the Y-shaped system of railroad-type rails which covers the site.

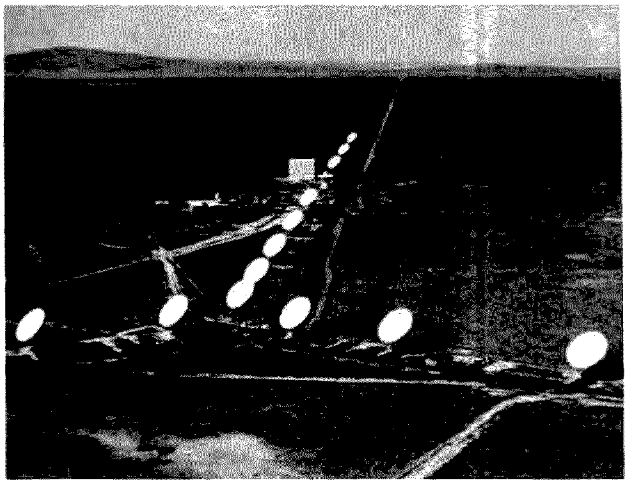
Each VLA antenna has a diameter of 82 feet. The antennas are working in the Cassegrain configuration. In this configuration, the main parabolic reflector reflects the incoming signals to a secondary reflector at the focus of the parabola. The receiving equipment which is located at the base of the main reflector receives the signals from the secondary reflector.

The receivers in the VLA are cooled to 18 degrees above absolute zero through refrigerators that are using liquid helium. All electronic components produce some internal electronic noise. The internal noise level is proportional to the temperature of the components. This noise is minimized by the refrigeration system in each VLA receiver. At room temperature, the internal noise in the components would overwhelm many of the weak signals that are being received from space.

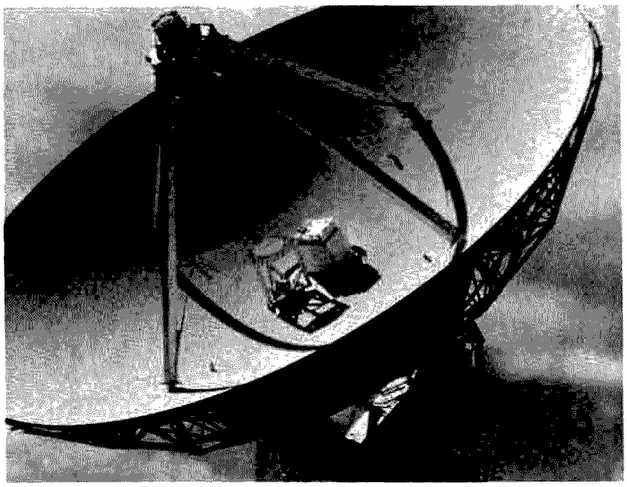
The aiming of each antenna in the VLA is controlled by a computer in the observatory's control building. The antennas can therefore follow an object as it moves across the sky due to the rotation of Earth with a very high degree of accuracy.

Each antenna in the VLA is connected to the control building through two-inch waveguides. The waveguides are part of a two-way communications system, as these are transporting the received signals from the antennas in one direction and the control signals from the central computer to the antennas in the other direction.

The antennas in the VLA are not self-propelled. A special rail transporter is used to move the antennas in the VLA from one site along the Y-shaped pattern to another. Each antenna with foundation weighs 235 tons. The transporter supplies the antennas with electrical power when they are being moved, so the receivers are cooled also during transportation. This is necessary in order to maintain the stability of the electronic components in the receivers. The transporter can usually move an antenna from one site to another in two hours. It takes a



Aerial view of the VLA. The large building in the background is the assembly building, which now is being used to repair and maintain the antennas. The other buildings in the photograph contain laboratories, offices, and computer equipment.



Close-up of one of the 27 VLA antennas.

week to reconfigure the entire antenna system in the VLA.

The antennas are repaired in a large building which initially was used to assemble the antennas on their foundations. The transporter is used to move each antenna to the assembly building for scheduled maintenance and for repairs. Complex electrical motors are used to move each antenna in the horizontal and vertical directions, and these also need regular maintenance in the assembly building.

The VLA antennas can be positioned in four main configurations. In the most dense configuration, all 27 antennas are crowded inside an area with a diameter of only 4000 feet. The most extensive configuration is one in which the antennas are located in a pattern across the entire 21-mile span of the observatory. By combining the four configurations, one can achieve an effect which is similar to that of a zoom lens. In the most dense configuration, the VLA can observe a large area of the sky, but with little detail. In the most extended configuration, it can study a small area of the sky in great detail.

The resolving power of the VLA exceeds that of any other radio observatory. Only in sensitivity is it exceeded by another radio observatory, the Arecibo observatory in Puerto Rico (see "Stare-Way to Heaven," *73*, August, 1984). The sensitivity of a radio observatory to weak signals from space is related to its antenna area. The VLA array has a sensitivity which would equal that of a single antenna, 430 feet in diameter. The Arecibo observatory has a diameter of 1000 feet.

The control building at the VLA contains computers that analyze the signals from each antenna. These computers make millions of calculations each second in order to enable the observing scientists to form an image of the object which is being observed, or to produce the radio spectrum of the emissions from the object. The data also can be recorded on magnetic tape. In this way, an astronomer may not even have to be present at the observatory when his observations are made. The image of an object can be constructed days or even weeks after an observation was made, through use of magnetic tape.

Most of the observations at the VLA are processed into radio images that resemble photographs. The resulting image presents the object as if one had a camera which was sensitive to radio waves instead of light waves. Colors are used to distinguish different levels of intensity in the received radio image. The final product of the VLA is usually an article in a scientific journal or publication describing new discoveries.

The rotation of Earth is utilized as a tool by the VLA. As Earth rotates, the space between the Y-shaped arms of the observatory is gradually being filled in. After a few hours of observation, data has been assembled, almost as if the array consisted of a solid reflector measuring 21 miles from one end to the other. The resolution which can be achieved through this technique is superior even to that of the largest optical telescopes.

Much of the sensitive receiving equipment and control equipment which the VLA uses is developed in laboratories which are part of the VLA facility. A number of improvements in the low-temperature refrigeration systems have also been developed by these laboratories.

Like other radio telescopes, the VLA is capable of observing the sky in broad daylight. The observatory is therefore in use around the clock. Astronomers from all over the world may compete for observing time at the VLA observatory. Allocation of observing time at the VLA is usually based on an evaluation of the scientific merit of each proposed set of observations.

Space is filled with magnetic fields of varying intensities. Whenever an electron moves in a magnetic field, its movement is altered. Whenever an electron changes its speed or direction, an electromagnetic wave is emitted, often at radio wavelengths. The VLA and other radio observatories are therefore able to collect a great deal of information about the magnetic fields which may play an important role in the formation of stars and galaxies.

A lot of information can be obtained on a distant object through its rf spectrum. Many elements and chemicals have emissions which may be identified in this spectrum, and movements and temperatures in the object result in Doppler shifts and widening of the spectral lines. Through the spectrum, an astronomer can therefore determine much of the chemical composition, movement, and temperature of a distant object.

The VLA is often used to

study the centers of distant and nearby galaxies. Even the center of our own galaxy can be observed by the VLA. The light from the central region of the Milky Way is obscured from us by dust and gas which lies between the solar system and the center of our galaxy. The longer radio waves are able to penetrate all this dust and gas, however, so that they can produce radio images of our galactic center. These images indicate that there is a lot of energy being radiated from violent processes near the center of our galaxy. Images of other galaxies show similar powerful emissions from the center. Many astronomers believe that these observations can be explained only by assuming that there are huge black holes near the centers of the Milky Way and other galaxies.

Galaxies which emit much more energy in the radio wavelengths than normal galaxies are called radio galaxies. Many radio galaxies have huge radio lobes that extend far beyond the visible limits of the galaxy. These radio lobes seem to originate near the center of these galaxies and appear to consist of charged particles that are streaming away from the center at velocities that approach the speed of light. Scientists at the VLA have devoted a lot of observing time to the study of radio galaxies. One of the nearest of these galaxies is called Centaurus A. If the radio lobes of Centaurus A could be seen in visible light, these would be one of the largest objects in the sky. The radio lobes of Centaurus A cover a larger area of the sky than the full moon.

The remants of supernovas, or stars that exploded, are among the strongest emitters of radio waves in the Milky Way. A supernova explosion leaves a large expanding shell of hot gases and dust. At the center of this shell, a rapidly rotating neutron star can usually be found. The VLA has been used both for the mapping of many supernova shells in the Milky Way and in the search for rotating neutron stars. A rotating neutron star will appear as radio pulses that are repeated with such a regularity that these cosmic lighthouses could be used to measure time.

Sunrise at the VLA.

Some of the brightest radio emitters in the universe are also among the most distant objects in the sky. These objects are called quasars and are believed to be located near the center of extremely distant galaxies. The radio waves from most of these sources have spent billions of years in their journey towards us. The VLA has participated in many research programs on quasars. The long time which the radio waves from the quasars have spent underway means that when it is observing a quasar, the observatory is actually looking at an object as it appeared billions of years ago.

VLA antenna on the rail transporter which is used to move the antennas from one site to another.

Even greater resolution of distant objects than that which can be achieved with the VLA can be made possible by combining the observations from several observatories across a continent. This is routinely being done by a network of radio observatories which includes participants on both the east and west coasts of the United States. The VLA itself participates in many of these studies. This type of observation, which is called Very Large Baseline Interferometry, may even involve observatories on other continents, such as in Europe and South America. If funding for the project can be obtained from the US Congress, construction of a Very Large Baseline Interferometry Array will start in a few years. This will consist of 10 VLA-type antennas located at sites in Hawaii, Puerto Rico, and across the continental United States. The movement of each of the 10 separate antennas in this array will be controlled by a master computer in Socorro. This continent-wide array will thus act as an extension of the VLA and will allow us to observe many interesting objects in the sky in an amazing degree of detail.

The Very Large Array welcomes visitors to the observatory. The VLA facility includes a visitor center which is open from 8:00 am until sunset every day. The visitor center contains displays on radio astronomy and a detailed description of the array and how it is operated. A self-guided tour is also available, so that a visitor may have access to many of the interesting facilities of the observatory. ■

D. A. Emmett ZS2RH
PO Box 7968
Newton Park
Port Elizabeth, 6055
South Africa

WARC for the FT-101E

Here's how to join the fun on our new 12-meter band. And you'll be ready for 18 MHz, too!

The FT-101E series of transceivers has no provision for the new bands, and since I am well satisfied with the operation of the FT-101E, I did not feel inclined towards the expense of changing to one of the later models which includes these new bands.

A thorough study of the schematic and the innards of the transceiver revealed that, with careful working and not rushing things, the modifications required would be relatively simple. (By the way, the handbook states for the "Aux" position of the bandswitch: "any 500-kHz coverage between 14.5 and 28.0 MHz." Don't believe it; it works FB for 24.5, but certainly not for 18. I know; I tried it.)

After consideration, it was decided to forfeit band 10D, as 29.5–29.7 MHz is never used by me and this position was used for the 24.5-MHz band. Simply plug in a 30.520-MHz crystal in place of the existing 35.52-MHz crystal and retune TC23 to obtain the correct output at the test point on PB1181 (rf unit), namely 0.3 V rms on the rf voltmeter, and the rig will work perfectly on the 24.89–24.99-MHz band. There is no need to touch the alignment of the rf and driver stages TCs, as these are tied together for the 10m bands, and the inductance variation in the "preselect" tuning takes care of the lower frequency quite adequately.

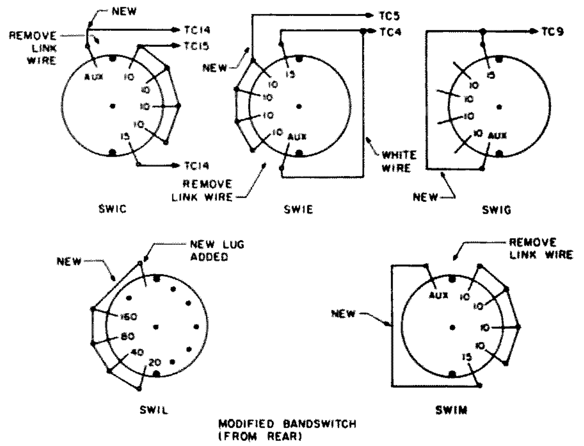


Fig. 1. Modified bandswitch (from rear).

The 18-MHz band is put into the Aux position and requires a little work on the various circuits in addition to plugging in a 24.02-MHz crystal and tuning TC24 for the required 0.3-V-rms output to PB1181. Fortunately, all the work is done at the bandswitch, although the chassis must be removed from the cabinet to facilitate working on the various switch sections. The chassis is upside down, and references to top and bottom refer to positions with the chassis so placed.

In making the modifications, each switch section should be worked on and completed separately. I started with the easy one, i.e., SW1M. The connection between the Aux and the 10m lugs is removed and a heavy wire is soldered between the Aux and the 15m lug. This completes SW1M.

The various switch poles can be identified and checked by setting the bandswitch to the required position and checking the rotor wiper blade which will be in the required position. This is important when working on the other switch wafers as there is very little space, and without a good light spotted on the wafer being worked on, it is almost impossible to see anything. In addition, a soldering iron with a long, thin bit should be used because of the lack of space for working.

I next tackled SW1G. It will be seen from the schematic that there are no connections to the Aux and 10m switch lugs so that the only thing to do is to connect the Aux lug to the 15m lug. This is a little awkward, and the reason for the long, thin bit on the soldering iron will be obvious. Note that SW1G is the 8th wafer from the front, not the 7th as would be expected. It is in the driver plate compartment.

SW1E is the most difficult and awkward; this is the 5th wafer from the front. The first thing is to break the connection from the Aux lug to the 10m lugs. As this lug is on the bottom of the switch, ordinary cutters cannot be used: There is only about 3/8" working space. I overcame the difficulty by using a very thin round file, and slowly filing through the connecting wire. This requires a great deal of care and patience. When this was completed, the short pieces of wire that remained were bent out of the way. From the Aux lug, a white wire goes to TC5; this connection to TC5 is removed at the trimmer PCB, and the white

wire is used to connect the Aux lug to the 15m lug. A new wire is soldered to the 10m lugs at the top of the switch wafer and then connected to TC5. The 15m lug is already connected to TC4 and needs no further attention.

The modification of SW1C, 3rd wafer from the front, proved easier than at first expected. I started by removing the connection between the Aux and 10m lugs positioned on top of the switch wafer. A wire is soldered to the Aux lug and fed over and soldered to TC14 (15m trimmer); this connection is made on top of the trimmer PCB.

At this point, I put the whole rig together again and fired it up to check tuning and performance into a dummy load. Everything was FB on all bands except 18 MHz. There was not enough capacity in the one section of VC2, which is used on 15 MHz and above, to load the output satisfactorily. So, the rig was opened up again as it was obvious that more capacity had to be introduced in the loading for the 18-MHz band.

After much thought and study, I decided to modify SW1L by adding a new contact lug at the Aux position on top of the wafer. A lug was removed from an unused spare rotary switch that was on hand; this was done by carefully drilling it out and removing the rivet holding it. This lug was then mounted in position on SW1L using a very small bolt and nut, and a stiff wire bridged it over to the 160m lug on the switch. (A spot of solder on the nut and bolt prevents movement.) The lug must be carefully positioned and set so that the rotor wiper arm makes a good clean contact and moves smoothly.

The rig was now reassembled and tested into the dummy. All bands, including 18 MHz, were now capable of being tuned normally. The measured outputs into the dummy (CW tested) were 110 Watts on 24.5 and 28 MHz and 125 Watts on 18 MHz and other bands.

Band	Preselect	Plate	Load
28	9.2–9.6	8.7–9.1	3.0
24.5	8.0	7.5	2.6
21	8.8	7.9	2.0
18	7.3	6.9	2.0
14	7.0	7.0	2.0
7(low)	5.1	4.5	3.0
3.5(low)	3.2	2.3	2.0

Table 1. Dial readings.

As these bands have been available in ZS for over a year, an air test using a very rough and ready dipole, badly installed, produced two TR8 stations on the first CQ call.

As a guide, the dial readings given in Table 1 for the various controls are as recorded by the writer. Different installations will produce variations.

Upon consideration, and with a good deal of hindsight, it would seem that SW1L need not be modified. The addition of a 200-pF (1,000-V) capacitor in parallel with VC2 (the front section which is in circuit on all bands) would provide ample capacitance for loading on 18 MHz and would only cause the tuning of the other bands to be moved towards the center of the load dial.

I have ignored the modification to put the FT-101E series on 10 MHz, first because it was admirably covered by WB9DDF in the November, 1983, issue of *73*, and second that band does not interest me. ■

The Dayton Downlink

Optimizing your OSCAR downlink system can be frustrating. Use this easy method to measure your improvements and know just when to stop.

Jerome T. Dijak W9JD/8
4854 Leafburrow Drive
Dayton OH 45424

In designing a downlink station for AMSAT-OSCAR 10 satellite reception, the main goal is to develop a setup where system noise is as low as possible compared to the extremely weak signals coming from the satellite. Sounds simple enough, but it is important to be able to characterize the performance of the system as it is being assembled so that when you are finished, you can at least rest assured that you have done the best you possibly could.

I have read in several publications that, at 146 MHz, system noise will be limited by the inherent noise in the downlink electronics. If and when this is the case, the optimum downlink is the one with the lowest possible noise figure. My experience has been, however, that system noise is often limited by external or atmospheric noise (that which is picked up by the antenna) and not by the noise produced within the electronics. When *this* is the case, no improvement will be gained by further reduction of the noise from the equipment.

This article will describe techniques for characterizing the internal and external sources of noise affecting an OSCAR Phase III satellite downlink station and will assume the availability of only an ac voltmeter and an rf 50-Ohm termination as test equipment. It is written with the 146-MHz downlink signal of AO-10 in mind, but the techniques could be applied at other frequencies as well.

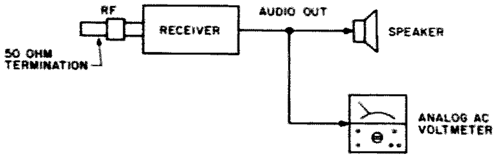


Fig. 1. Basic noise test setup.

Terms

I'll be using some terms which may not be familiar to all readers. By "intrinsic noise" I mean all noise sources inherent to the electronics of the receiving system, while "extrinsic noise" refers to all noise sources external to the receiving system (i.e., picked up by the antenna), whether they be man-made or natural.

"Noise figure" is a figure of merit for an amplifier or receiving system. It is expressed in decibels (dB) and the lower the number, the better. A typical mediocre noise figure at 146 MHz is 4 dB, while a really good one would be 0.5 dB.

"System noise floor" refers to the baseline audio noise output of a receive system when the antenna is connected and no signals are present. It represents the combined effects of both intrinsic and extrinsic noise sources and is the reference level for system signal-to-noise measurements.

Test Signal Source

To make noise measurements on our system we need a very weak "signal" source. It turns out that most of the time the noise simply picked up by the antenna will be an adequate signal for our measurements. It may be a little hard at first to think of noise as signal, but in this case it will work just fine.

The goal is to develop your receiving system so that its intrinsic noise is less than that coming from the antenna naturally, so using the antenna noise as a source in doing our measurements is very logical and effective.

If you *cannot* hear any increase in output noise from your system when connecting an external antenna (compared to the noise output with a 50-Ohm termination at the rf input), then your intrinsic noise already dominates your signal-to-noise ratio and you may wish to start taking steps to reduce the intrinsic noise of your system (discussed later). In this case, since the antenna noise is not strong enough to hear, you will need to use a simple diode

noise generator (see the *ARRL Handbook*, among other sources) as a noise source for the measurements described below.

Noise Measurements

Fig. 1 shows the equipment configuration for making noise measurements with simple equipment. We will not have the capability to establish an absolute noise figure for our system (we do *not* assume the availability of a calibrated noise source or a true noise figure meter), but we really don't need that anyway. We are really just interested in *optimizing* our system for minimum intrinsic noise, which can be done adequately with simple equipment.

The "receiver" may be either a true 2-meter receiver or a 2-meter downconverter in front of an HF receiver. For this discussion, the distinction is unimportant. The audio output is routed to a speaker (or headhones) as well as to a high-impedance audio (ac) voltmeter. The noise levels to be measured will probably vary somewhat, so an analog meter will be best for "eyeball averaging" readings when necessary.

The voltmeter provides a very good way to obtain an averaged reading of the noise levels. The speaker is used to monitor the audio to ensure that we always are dealing with just random noise and not intermodulation products or other spurious signals which might show up at times.

The basic procedure is quite simple. With the rf input terminated with a 50-Ohm termination, fix the rf gain full open with avc disabled and adjust the af gain of the receiver for a level which produces a 10–20% meter deflection on the voltmeter. This establishes the reference noise level.

(You may notice that your receiving system is quieter with nothing at all connected to its rf input than it is when its input is terminated in the proper characteristic impedance, but the unterminated case is an unrealistic operating condition and is not of any use to us.)

Then, after changes are made (perhaps just connecting the antenna), note the new audio output level that is obtained without changing any of the receiver gain controls. The ratio of these two voltages provides a direct measurement of the signal-to-noise ratio (actually the (S+N)/N ratio) for the system under test. We will be interested in making this type of measurement under a variety of conditions.

We will always want to deal in decibel ratios. If you happen to have a meter with a scale calibrated in dB, you have it easy. If not, you may use a pocket calculator to apply the formula $dB = 20 \log_{10}(V_1/V_2)$, where V_1 and V_2 are the two voltages being compared.

Characterizing Intrinsic and Extrinsic Noise

The first item of interest is to compare the extrinsic noise to the intrinsic noise. We use the setup shown in Fig. 2, where we assume that a complete downlink station has been assembled. At the point where the feedline connects to the receiver, we also prepare a 50-Ohm termination plug (preferably shielded). For the moment, we assume nothing about the quality of the receiving system or its intrinsic noise.

The procedure is to install the 50-Ohm termination at the receiver's rf input, adjust the audio level to a 10–20% deflection voltmeter reading (with the rf gain at maximum and avc disabled), and make note of this level. Then remove the termination and connect the antenna and feedline. One of two things will happen: Either the noise level will increase (indicating that the extrinsic noise level is greater than or equal to the system intrinsic noise) or the noise level will not change (indicating that the extrinsic noise level is negligible when compared to the system intrinsic noise).

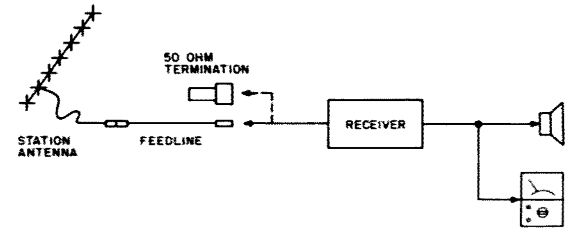


Fig. 2. Characterization of intrinsic and extrinsic noise.

In the first case, you need do nothing further to decrease the noise figure of your receiving system. The output noise level is already being dominated by the extrinsic, atmospheric noise, and lowering the intrinsic noise of the equipment will have no noticeable effect on the output signal-to-noise ratio.

In the second case, the overall system noise floor *is* being dominated by the intrinsic noise of the equipment and if you can take steps to decrease this, you can decrease your overall system noise level and improve your output signal-to-noise ratio. This is the more desirable situation, since it allows you to *do* something to improve system performance. Once you reach the level of the extrinsic noise in your location, however, you can improve things no further—unless you can first do something to reduce the extrinsic noise at your antenna.

Reducing Intrinsic Noise

If intrinsic noise is dominating your system, do what you can to reduce it. Beyond obvious problems like hum and noisy power supplies, however, you quickly get into a "black art" area where creativity, experience, and patience are the tools used to tune a receiving system for minimum intrinsic noise. With the exception of simply adding a preamp, a discussion of noise reduction techniques is beyond the scope of this article. If you want to get into this area, my advice would be to find a wise local expert and enlist his aid.

On the other hand, a relatively easy route to a quieter receive system is to add a high-quality preamplifier in front of it. Since the intrinsic noise of a receiving system is primarily determined by the characteristics of its first few stages, adding a state-of-the-art, low-noise, high-gain preamp is one of the easiest and most effective means of reducing intrinsic noise.

A good preamp produces lots of gain, typically 15–25 dB, while introducing very little additional noise; the gain (and noise generation) of the rest of the receive system can therefore be greatly reduced, with the result that the audio output signal-to-noise ratio is improved.

Fig. 3 shows some typical equipment configurations. If we assume an initial configuration something like that in Fig. 3(a), then we have the option of going to a configuration like that in Fig. 3(b) or 3(c) to reduce intrinsic noise. (Where we assume that the preamp is one with a better noise figure than the existing front end of the receiver.)

I recommend that you first try the configuration in Fig. 3(b), and after installing the preamp, again check the extrinsic noise. Remember that we started with a situation where the intrinsic noise was dominant (negligible increase in output noise level observed when the antenna was connected), but now you should have reduced the intrinsic noise considerably by installing the preamp; you need to see

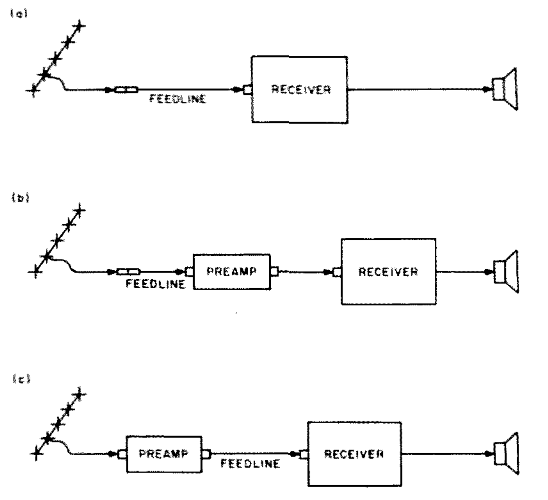


Fig. 3. System configurations.

how the intrinsic noise and extrinsic noise compare now.

If you find that the system noise floor is now being dominated by the extrinsic noise, you may stop, since any further reduction in intrinsic noise will not be noticeable once the antenna is connected.

But if you find that the intrinsic noise is *still* dominant and you want to take a little more trouble to reduce it further, you can go to a configuration like that shown in Fig. 3(c), with the preamp mounted right at the antenna. This is the optimum configuration for minimum noise figure, but the inconvenience of it is only warranted if the extrinsic noise is still below the intrinsic noise with the preamp installed at the receiver.

If after going to this configuration you find that your system noise floor is *still* dominated by the intrinsic noise, then you are either in a very quiet locale (lucky you) or you have a noisy preamp. In any case, if you are still in the game at this point, the next step is to buy or build a better and quieter preamp. But if you have done everything right up to this point and there are no serious problems with your equipment, you should be able to hear the satellite fairly well (a 10-dB output signal-to-noise ratio or better) if you have a 10-dB gain antenna.

One word of warning. High-gain preamps sometimes have a tendency to oscillate, especially if not terminated in impedances of exactly 50 Ohms, resistive, at input and output. If you find a lot of noise coming out of your preamp—either sporadically, like lightning crashes, or continuously—your preamp may be oscillating.

Antennas

You will want to use a gain antenna of some sort, preferably about 10 dB gain or more, and it is a good idea to spend some time characterizing the "noisiness" of your environment at various azimuths and elevations. Having done this, you will know in advance those beam headings that can be expected to produce good and bad signal-to-noise ratios for the same strength of satellite signal. Keep in mind, however, that the noise sources in the environment around you may change with time, so consider this just a general determination of good and bad areas.

For any particular operating occasion, the optimum procedure is to first determine the beam direction (azimuth and elevation) that yields the strongest signal from the satellite and then tune away from the satellite signals and try to find a beam direction in that general area of the sky that also minimizes the noise pickup. The idea being, or course, to maximize the *ratio* of received signal to received noise at the receiving system's input terminal.

Note that if your system noise floor is dominated by extrinsic sources, you may not notice any improvement in output signal-to-noise ratio by installing a larger, higher-gain antenna. Depending upon the side-lobe gains of the antennas as installed, the *ratio* of satellite signal to noise signals may increase, decrease, or not change at all when changing antennas since the noise sources in your environment are likely to be distributed in azimuth around you.

Circular Polarization

All available literature strongly recommends right-hand circular polarization (RHCP) for your AO-10 antennas. I will not contradict this advice since intuitively RHCP seems like the right thing to use, but my observations of the AO-10 beacon signal as well as general signals in the passband have shown that antenna polarization (whether linear or circular of either sense) usually makes no observable difference in the strength or quality of the downlink signals. I have not heard any credible explanation for this phenomenon, nor will I attempt to offer one.

Sometimes RHCP does work better than the others, but even with RHCP there is usually very strong spin modulation (fading) on the signals.

A Case Study

It might be interesting to relate the results of this sort of characterization on *my* downlink station.

My baseline 146-MHz receive system consists of an Advanced Receiver Research (ARR) R144VD downconverter working into a Drake R-4 running at 30 MHz. The R144VD has a noise figure specification of less than 1.8 dB. My preamp is an ARR P144VDG GaAsFET unit with a noise figure of less than 0.5 dB and gain of better than 24 dB, as specified by the manufacturer. (These absolute performance figures were not checked by measurement, due to lack of test equipment. The preamp and converter were both new, however, at the time of the measurements which follow.)

The antenna used for these tests was a 4-element linearly-polarized quad with a measured gain of 9 dB over a dipole.

The series of tests described in this article were carried out on this sytem, with several interesting results. The act of adding the preamp to the system at the downconverter (the configuration shown in Fig. 3(b)) improved the output (S+N)/N ratio by about 3.4 dB over that obtained with the configuration of Fig. 3(a).

Installing the preamp at the antenna (the Fig. 3(c) configuration) instead of at the converter improved the output (S+N)/N ratio by *another* 3.5 dB. (The feedline involved here is 85 feet of new RG-213 with a measured loss of 0.87 dB at 146 MHz.)

Even with the basic Fig. 3(a) system configuration, however, the local atmospheric noise averages 3-10 dB above the system intrinsic noise, while the AO-10 beacon signal appears at 3 to 10 dB above the local noise at various times. If local noise were not present, I would be able to hear the satellite's beacon with a quite respectable signal-to-noise ratio of 10 to 20 dB though, even without a preamp.

Since in this case the local noise exceeds the intrinsic noise even without the preamp, the reduction in system noise due to adding the preamp has no effect on

output signal-to-noise ratio. Were I in a very quiet location, however, adding the preamp mounted at the antenna would improve the output signal-to-noise ratio by 6.9 dB, which would be significant.

I do use the preamp in my system anyway, however, because of a secondary benefit. I use a computer in my station and it generates quite a bit of spurious rf at 30 MHz; these spurs are strong enough to degrade the reception quality of the weak satellite signals when no preamp is in use. Since the preamp boosts the signal levels at the 30-MHz i-f by 24 dB, however, it places the desired signals well above the computer spurs and improves the reception quality in that way, even though my output signal-to-noise ratio due to thermal noise is still dominated by the extrinsic noise and therefore is not improved by the preamp.

Summary

I have described a series of simple tests that can be carried out on any receive system with minimal test equipment to characterize the noise performance of that system relative to the local noise environment. This type of characterization is much more meaningful than an absolute characterization, such as a standard noise figure test, since the effects of the local environment are considered.

Using these procedures it is possible to determine in advance whether or not the addition of a preamp to a system is likely to improve output signal-to-noise ratio, as well as whether or not it is worth the inconvenience of mounting the preamp at the antenna.

In the end, you may not be happy with the quality of the downlink signals at your station, but at least you'll know why they are the way they are. ■

Steven E. Mann N4EY
PO Box 7351
Winston-Salem NC 27109

The 30-Meter-Plus Receiver

Explore the world of 10 MHz with a solid-state receiver you've built yourself! We've come a long way since oatmeal boxes and cats' whiskers.

Most of the older amateur rigs have no provision for the 30-meter band or for receiving the commercial CW and broadcast stations that also occupy the HF region. The receiver described in this article tunes 7.8 MHz to 12.1 MHz, which includes commercial CW and RTTY stations, SWBC, WWV, and the 30-meter amateur band. It is simple to build, easy to get operating, and doesn't cost a mint.

Fig. 1 shows the block diagram of the receiver and the schematics are shown in Figs. 2, 3, and 4. A single tuned circuit matches the antenna to the mixer and peaks the desired signal. A dual-gate MOSFET is used for the mixer, as it has a good noise figure and provides some gain, thus reducing the total number of stages in the receiver.

The vfo uses a JFET as a Hartley oscillator and another dual-gate MOSFET as a buffer amplifier. It is modeled on the W7ZOI and K5IRK design[1] but does not use the padding capacitance. This was left out in order to obtain the maximum tuning range from the oscillator, which is about 4.3 MHz in this case.

The output of the mixer is fed through a tuned circuit with a link output to a Heath filter of 2.1-kHz bandwidth and 3.395-MHz center frequency. The filter was a gift from KI4FJ, who replaced the filter in his SB-101 with a Fox-Tango filter. The 2.1-kHz bandwidth is suitable for the CW and RTTY stations that are found in the receiver's tuning range. It is also acceptable for AM reception when the receiver is tuned to either side of the carrier frequency.

The i-f amplifier is a single IC which provides better than 40 dB gain and provides the majority of the receiver's gain. To keep things simple, no agc is used. It is not necessary on CW and the manual i-f gain control on the front panel is adequate for the purpose. The output of this stage is taken through a link from L4. This transformer is single-tuned and peaked by the 300-pF trimmer in parallel with it.

The detector is the old standard single diode which functions well on AM. When an adequate amount of bfo energy is applied, it functions as a detector for CW, RTTY, and SSB. It was chosen for its simplicity and low parts count.

The bfo is a Colpitts crystal oscillator which was chosen for its simplicity and output. The switch from AM to CW operation is accomplished simply by switching the bfo's operating voltage on.

The audio section consists of two stages, a bipolar preamplifier and an IC audio power amplifier. The bipolar stage is necessary due to the small number of active stages ahead of the detector. There is sufficient gain for a small speaker and enough to blast a set of low-impedance earphones.

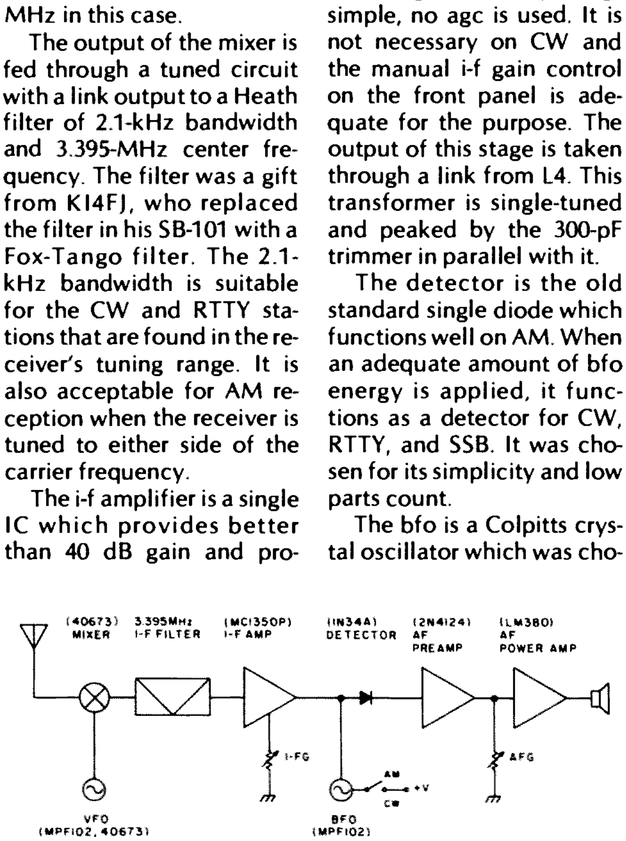


Fig. 1. Block diagram. The receiver operates on 12 V dc, uses low-impedance earphones or a speaker, and requires a low-impedance antenna.

Circuit Details

All coils were wound on toroid cores which were purchased from Amidon Associates.[2] Due to the large tuning range and the narrow filter, a gear reduction drive on the vfo tuning capacitor is a necessity. I used a WWII government-surplus capacitor from an ARC-5 transmitter which tuned 7.0 to 9.1 MHz. This was obtained at a hamfest but should also be available from other sources at a reasonable price.[3] It has a built-in gear reduction drive providing approximately a 49:1 turns ratio,

and a dial is also included. The unit provides less than 100 kHz of coverage per turn of the tuning knob, which allows easy tuning on CW. I covered the original dial numbers with a black felt pen and used typewriter erasure fluid for the new marks. The original small tuning knob was replaced with a large two-inch-diameter knob for more tuning ease. The cost of the surplus unit is less than the price of a new double-bearing capacitor, gear reduction drive, and dial when purchased separately.

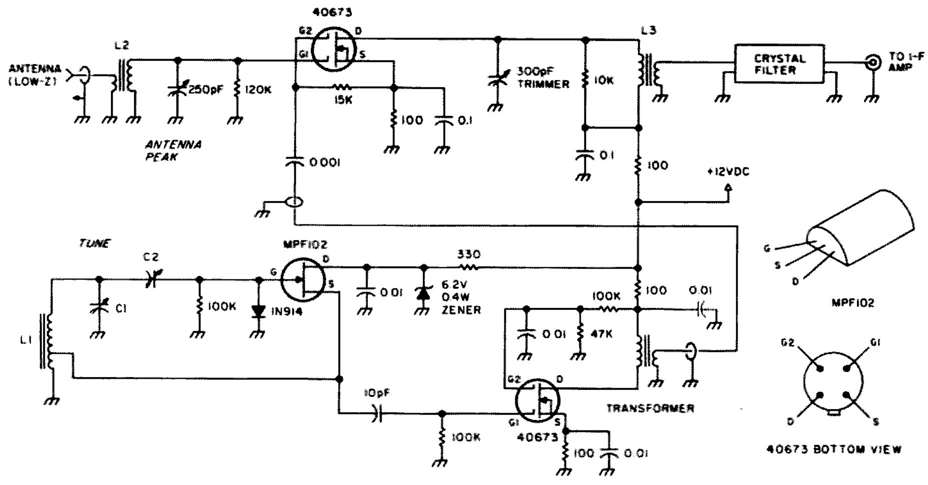
My receiver is built in modular fashion. The two ICs can be mounted on predrilled boards such as those available from Radio Shack.[4] The other circuits can be wired on pieces of PC board in point-to-point "ugly" style.[5] This allows quick and easy construction and modification. I used a combination of etched boards and ugly boards in my receiver.

The crystal in the bfo was purchased at a hamfest. It should be available from Heath or it could be ordered from one of several crystal manufacturers.[6]

My receiver was built in an aluminum cabinet which measures 3-1/2 inches high, 8 inches wide, and 9-1/2 inches deep. This was purchased at a hamfest for less than three dollars. Allow plenty of room for the front-panel controls: vfo knob and dial, antenna peaking knob, i-f gain knob, AM/CW switch (bfo power), af gain knob, earphone jack, and on/off switch. The rear panel contains a power connector and antenna jack. The receiver could easily be built in a smaller cabinet, but I like to have extra room for servicing and modifications.

Construction

The following sequence is recommended. Build the LM380 section first, then the preamp, the i-f, the detector, the bfo, the vfo, and finally



C1	170-pF capacitor from ARC-5 transmitter
C2	1.5–5.4-pF air trimmer
L1	44 turns, tapped at 12 turns above ground on Amidon T50-6
L2	24 turns wound on Amidon T68-2; 3-turn link to antenna
L3	50 turns wound on Amidon T50-2; 22-turn link to filter
XFMR	18 turns wound on Amidon FT37-43; 3-turn link to mixer

Filter is Heath part number 404-200 (Made by James Knight Company), 2.1-kHz bandwidth, 3.395-MHz center frequency.
Note: #28 enameled copper wire was used for all windings.

Fig. 2. Schematic of mixer, filter, and vfo sections.

the mixer. The bfo can be used as a signal generator to align the i-f transformers.

To do this, first disconnect the bfo output from the detector and reconnect it to pin 4 of the i-f amplifier. Plug in a set of earphones and turn on the power. Adjust the 300-pF trimmer in parallel with L4 for maximum noise or hiss output. Use a nonmetallic tool for this. Next, turn off the power and move the output of the bfo from the i-f to the drain lead of the mixer. Disconnect the filter from the circuit and connect the link of L3 to the coupling capacitor going to pin 4 of the i-f amplifier. Turn on the power and adjust the 300-pF trimmer in parallel with L3 as you did the other for maximum output. Turn off the power and reconnect the filter in the circuit and connect the output of the bfo to the anode of the detector.

If a frequency counter is available, dial calibration is easy, as the vfo operates 3.395 MHz lower in frequency than the tuned frequency. The dial can be calibrated by connecting the counter to the output of the vfo and adding 3.395 MHz to the counter's reading. For example, to tune 10.1 MHz, set the vfo to 6.705 MHz.

If a counter is not available, the following can be

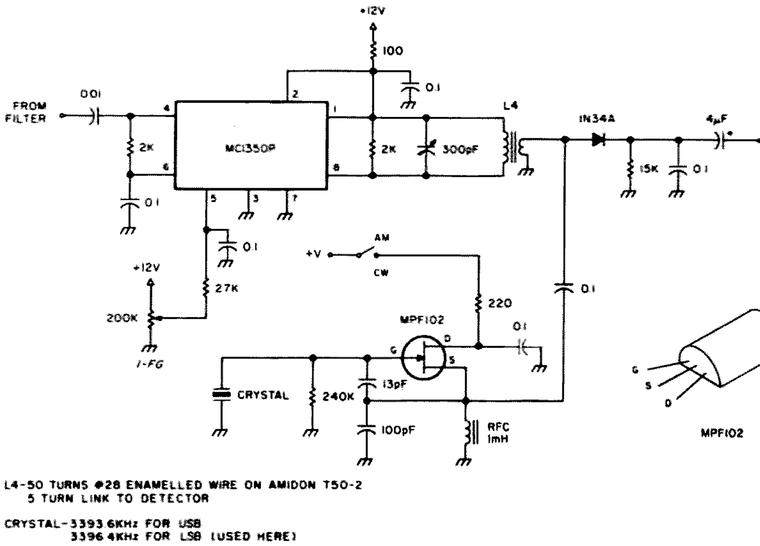


Fig. 3. Detector, i-f amplifier, and bfo schematic.

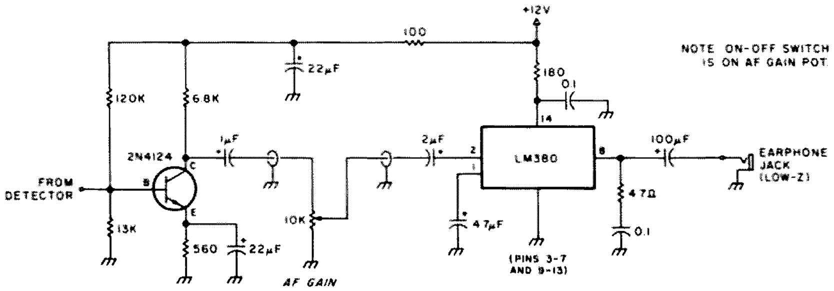


Fig. 4. Audio section.

used for approximate dial markings: Without an antenna, turn on the receiver and the bfo. Tune for the bfo's third harmonic at about 10.191 MHz. This should be easy to locate and will be found approximately at the midpoint of the dial. Next, connect the antenna and tune a little lower in frequency. The lowest frequency occurs when the vfo's capacitor is fully meshed and the antenna capacitor is almost fully meshed. If the time of day and conditions are right, you should be able to find WWV at 10 MHz. The 30-meter band, 10.1-10.15 MHz, will be found between WWV and the bfo's harmonic. You will find the 31-meter SWBC band just below WWV and the 8.5-MHz commercial CW band a bit further down. The 25-meter SWBC band will be found near the top of the vfo's range. If a crystal calibrator is available, additional tuning marks can be made as you wish.

To operate the receiver, set the i-f gain at maximum and peak the antenna capacitor for maximum noise with an antenna connected. The receiver is most sensitive when the bfo is turned on, so it is left on even when tuning in an AM station. Once the station is found, the bfo is turned off and the receiver is fine-tuned for best audio response. The af gain control is set for a comfortable listening level and the i-f gain is adjusted to prevent overloading of the detector. CW and RTTY stations are tuned in a similar manner, except that the bfo is left on. The antenna tuning capacitor will be quite sharp at low frequencies and will require frequent adjustment. At the upper end of the dial, frequent adjustment will not be necessary.

I have had a lot of pleasure from this receiver and hope that you will, too. If you have any questions or comments I will try to answer them if you enclose an SASE.■

References

1. "A Progressive Communications Receiver," W7ZOI and W5IRK, *QST*, November, 1981, p. 11.
2. Amidon Associates, Inc., 12033 Otsego Street, North Hollywood CA 91607.
3. Fair Radio Sales, 1016 E. Eureka Street, PO Box 1105, Lima OH 45802.
4. Radio Shack items #276-024 or 276-159.
5. "The 'Ugly Weekender'," KA7EXM and W7ZOI, *QST*, August, 1981, p. 18.
6. Two crystal manufacturers that I have used with satisfaction are: International Crystal Manufacturing, 10 North Lee, Oklahoma City OK 73102, and Jan Crystals, PO Box 06017, Fort Myers FL 33906.

Raymond W. Ketchledge
1785 Chadwick Road
Englewood FL 33533

The Incredible Inducto-Gauge

Measure coils with impunity! Better yet, measure them with this weekend project: a do-it-yourself inductance meter.

One of our measuring instruments is missing! We have capacitance meters, ohmmeters, and frequency counters, to say nothing of volt and current meters. But we don't have a small inexpensive instrument for inductance (L) and Q. Impedance bridge and similar methods are costly and often limited in frequency range. What one would like to do is to be able to measure inductance from small fractions of a microhenry to thousands of henrys and do it from a few Hertz to tens of megahertz. With the L Meter and a frequency counter you can now measure inductance and find the resonant frequency of tuned circuits as well.

The L Meter is different in that it provides the unknown inductance not only with a selectable tuning capacitor but also with an adjustable negative resistance to make it oscillate. The counter measures the frequency of oscillation and, knowing the tuning-capacitor value, permits the inductance to be calculated. Of course, much of the time the use of a reactance chart to find the inductance is accurate enough. The reactance chart also gives the reactance, X, of the coil, and the L Meter gives the anti-resonant impedance, QX. The ratio is Q so you can also find shorted turns, etc. If you have a TI-58 or -59 calculator with the electrical engineering module, these calculations are easily done with program EE-11, Reactance Chart.

The heart of the L Meter is the trio of transistors, Q1, Q2, and Q3. See Fig. 1. The first two are followers driving Q3, which is a grounded-base amplifier. The gain

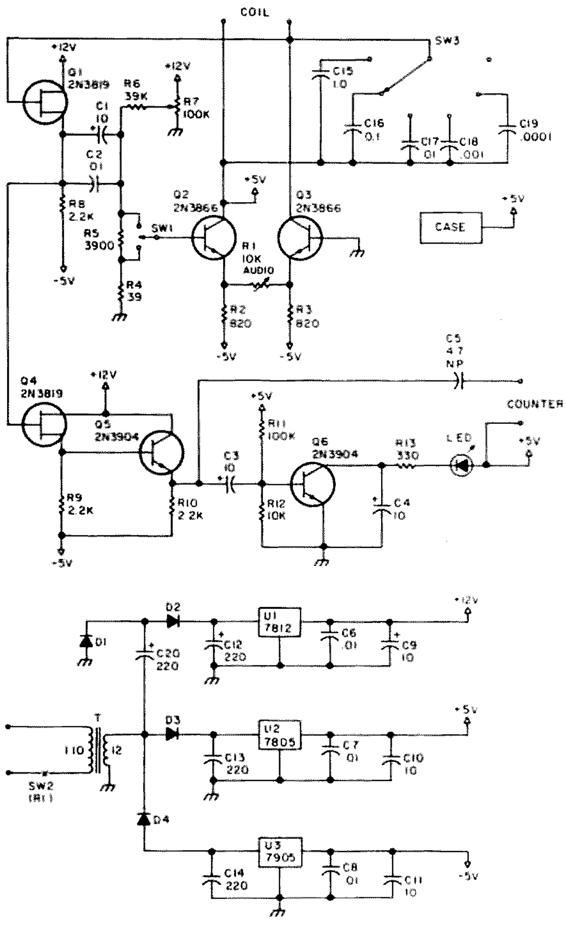


Fig. 1. Schematic.

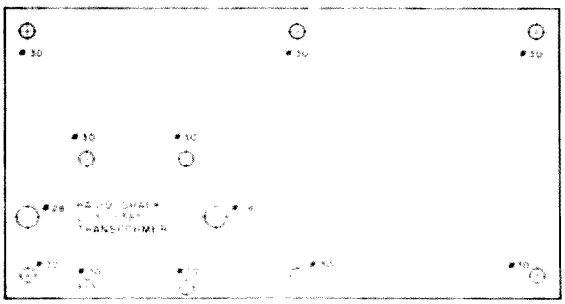


Fig. 2. Perfboard, hole placement.

around the loop is controlled by the shunt impedance of the tuned circuit and the series resistance of R1. If the transistors were ideal, then unity gain would occur when these two impedances were equal. Actually R1 has to be about 85% of the tuned-circuit impedance to make up for the losses around the loop.

Suppose the tuned circuit is oscillating with a voltage, V. With switch SW1 on the times 1 contact, Q1 and Q2 deliver a little bit less than V at the emitter of Q2. Since the emitter impedances of both Q2 and Q3 are low, the current into the emitter of Q3 is a bit less than V/R1. Most of the current into the emitter of Q3 comes out the collector and produces voltage across the tuned circuit. Q1 does not take any significant current because it is a field-effect transistor and it is a follower. Thus, if the coil has a reactance, X, and a quality factor, Q, the largest value of R1 that will let oscillation continue is approximately equal to QX. In order to measure tuned-circuit impedances up to a megohm, switch SW1 reduces the follower gain by 100 and multiplies the R1 scale by 100.

To make a useful instrument a few more things have to be added. Obviously we need a power supply and a switched bank of capacitors for the tuned circuit. We also need an output to the counter that does not load down the tuned circuit and disturb the measurement. We also need an indicator to tell when the circuit is oscillating.

R1 must be adjusted to make the circuit barely oscillate. We want oscillation but not overload which would give frequency shift and measuring error. Also, to make the adjustment of R1 quick and simple, we do not want to wait to see if the counter is responding. Thus, followers Q4 and Q5 pick off the signal for the counter and also drive Q6, the oscillation detector. Q6 is biased so that even a .1-volt signal will cause the LED to start to glow. This will detect oscillation in tuned circuits even when their anti-resonant impedance is less than 100 Ohms.

The power supply is conventional except that three voltages are delivered and all are regulated. The regulation is needed to allow the circuit to stay on the edge of oscillation without constant readjustment. Also, regulators are a simple way to filter out hum. Ideally the transformer should deliver about 8 volts and some 6.3-volt units do. However, many do not, being wound with bigger wire and therefore allowing for less drop under load. The 12-volt unit is sure to work.

Because the frequency of oscillation can cover such a wide range, it is important to keep leads short and to bypass the power-supply outputs carefully. The coupling capacitors, C1 and C2, must be low impedance to the signal. The use of an electrolytic capacitor in parallel with a ceramic provides the wide frequency range bypass action. For the same reason transistors Q1 and Q2 are 500-MHz units.

To measure inductance from 1000 H to .1 uH covers a range of ten decades. Letting the frequency go from 5 Hz to over 50 MHz, seven decades, allows us to use only 4 decades of capacitor tuning range. Since small inductors tend to tune with small capacitors and to higher frequencies, the L Meter only needs to measure about a four-decade range of anti-resonant impedance. In addition, the higher impedances tend to be at the lower frequencies, where it is easier to maintain high transistor-input and -output impedances. Thus these factors work together to make the L Meter an accurate, wide-range, inductance-measuring device.

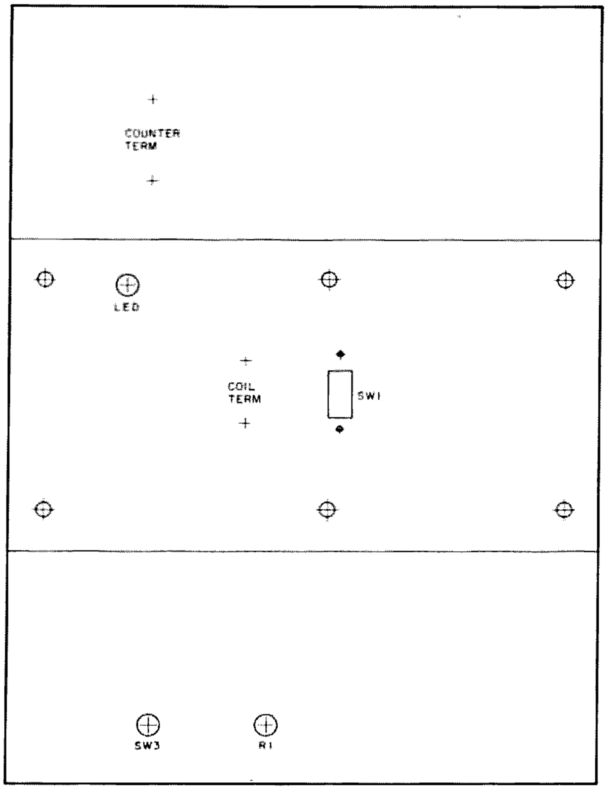


Fig. 3. Drilling positioning guide.

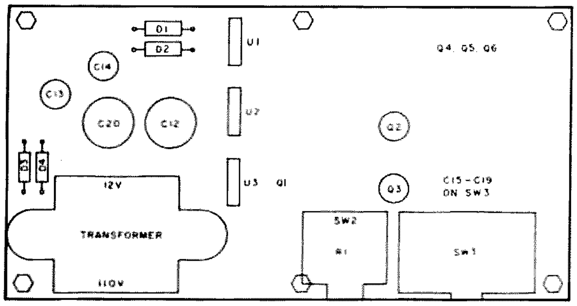


Fig. 4. Parts placement, bottom view.

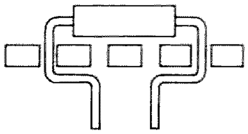


Fig. 5. Lead clinch.

Construction of the L Meter can start with drilling the necessary holes in the 2-1/2" by 4-3/4" piece of perfboard. See Fig. 2. The perfboard will be mounted on the aluminum box with six 1" 4-40 machine screws. Six are used to maintain rigidity. Fig. 3 shows the corresponding drilling and cutout information for the 5" by 3" by 2" box. Note that only the part whose panels are all 5" long gets drilled. The part with the 2" by 3" ends is used as is.

The transformer can be mounted on the perfboard first, keeping the 110-volt terminals towards the outside edge of the board. Fig. 4 gives a suggested layout of the parts. Mount the parts by bending the leads as appropriate and pushing the leads through the holes in the board. Using long-nose pliers, the leads can be bent as shown in Fig. 5 to clinch the part to the board. Much of the part-to-part wiring can

Parts List

Capacitors	
C1, C3, C4, C9, C10, C11	10 uF, 25 volt, electrolytic
C2, C6, C7, C8	.01 uF, ceramic
C5	4.7 uF, 16 volt, nonpolar
C12, C13, C14, C20	220 uF, 35 volt, PC
C15	1 uF, 50 volt, film
C16	.1 uF, 50 volt, film
C17	.01 uF, mica
C18	.001 uF, mica
C19	.0001 uF, mica
Resistors, fixed are 1/4 W, 5%	
R1	10k pot with switch, audio taper
R2, R3	820 Ohm
R4	39 Ohm
R5	3900 Ohm
R6	39k Ohm
R7	100k trimpot
R8, R9, R10	2.2k Ohm
R11	100k Ohm
R12	10k Ohm
R13	330 Ohm
Semiconductors	
D1, D2, D3, D4	1-Amp 100-volt rectifiers
U1	7812 12-volt regulator
U2	7805 5-volt regulator
U3	7905 – 5-volt regulator
Q1, Q4 RS 276-2035	2N3819 FET
Q2, Q3 RS 276-2038	2N3866 500 MHz NPN
Q5, Q6	2N3904 NPN
LED	light-emitting diode
Miscellaneous	
SW1	SPDT slide switch
SW3	SP6T rotary switch
Perfboard	
Transformer	110 volt to 12 volt, 300 mA
4 push-button terminals	
Power cord, grommet	
2 3/4" knobs, 1/4" shaft	
Bond paper	
6 1" 4-40 machine screws, nuts and lock washers with 6 5/8" fiber spacers	
Aluminum case, 5" × 3" × 2"	

be made using the lead wires themselves. A lead as in Fig. 5 can be used as a wiring terminal with other connecting leads wound around it and then soldered. This wiring method is simple and quick. It also leaves component leads longer than printed wiring does, which is helpful when you want to salvage parts from a discarded project.

Ideally, tuning capacitors C15 to C19 should be as accurate as possible. If you have access to a capacitance meter you can select the appropriate units. Even if you cannot find units within a few percent of the values, 1.0, 0.10, 0.010, 0.0010, and 0.00010 uF, you can at least record the values so that when you need accuracy you can calculate using the actual capacitance. Remember the circuit has about 40 pF of stray capacitance, so allow for that in the 1000-pF unit. Also, the fifth capacitor ought to be chosen after the L meter is working and in the case. The total tuning capacitance should be 100 pF, so C19 will be about 60 pF. Note that the sixth position of SW3 has no capacitor. This is useful for measuring very small inductances. You can find the value of the stray capacitance by measuring a small inductor using a larger capacitor, say 0.001 uF, and then finding the frequency with strays only. With the measured inductance and the strays-only frequency, the stray capacitance can be found.

Glue a 4" by 2" piece of bond paper to the side of the case where switch SW3 and R1 are mounted. Install the knobs. Using a sharp pencil mark the six switch positions and their capacitance values. Then connect an ohmmeter to R1. Mid-scale should be about 1500 Ohms. If not, you are using the wrong end of the pot. One side of R1 must be disconnected from the circuit to measure R1. Mark an Ohms scale from 100 to 10,000 Ohms. Measure 30 Ohms and mark it as 50. This allows for series emitter impedances. This calibration is accurate enough for most purposes. A more accurate scale can be created by starting with a very high impedance tuned circuit and shunting it with various resistors, calculating the net shunt resistance and marking the scale accordingly. Remember to always set R1 to the point where oscillation just starts.

One other detail: Set R7 so that the voltage at the emitter of Q2 does not change when switch SW1 is operated. You will also note that the coil being measured carries about 5 mA of direct current. Some large, metal-cored coils may be sensitive to this current. A PNP transistor can be arranged as a current source from the +12 supply to the collector of Q3 and adjusted to make the coil current virtually zero. If you try this, be sure to bypass the base of the PNP to keep signal off the base. Otherwise the current source will load the tuned circuit. The disadvantage of the current source is that it adds stray capacitance. ■

The Peerless Power Pack

Simplicity is the key to this rugged 12-volt, 5-Amp supply. If you're looking for quick energy, here's the answer.

Thomas F. Nolan KO2G
RD 2, Box 209
Wrightstown NJ 08562

Objective: To design and and build a simple 12-volt, 5-Amp dc power supply with over-voltage protection in case of regulator failure. Here is my solution.

The power transformer is a Stancor Universal rectifier transformer, model RT204, which is rated for 4 Amps of current when used in a full-wave bridge circuit; however, there does not seem to be any problem using this transformer at 5 Amps. The bridge rectifier, VT200, is a single package rated at 25 Amps. C1 is a hefty filter capacitor of 8900 uF. The LM338 is a 5-Amp adjustable power regulator with 5-Amp output and built-in current limiting. R1 is to adjust the output from 9–14 volts. Diodes D1 and D2 are protection diodes to prevent C2 and C3 from discharging through the regulator during turn-off of the power supply. C4 and C5 are to prevent the regulator from oscillating at a high frequency. R2 is to maintain a minimum load in conjunction with the LED to create approximately a 70-mA load. The minimum load is needed to prevent the regulator from dropping out of regulation.

If the regulator should fail, causing the output voltage to climb toward the input voltage of the regulator, the 12-volt zener diode, Z1, will turn on at 14.4 volts in conjunction with the gate of the SCR, which will turn the SCR on, causing the fuse, F2, to blow, which will remove the current from the regulator, preventing damage to equipment used with this power supply. R6 and C5 are used as a filter to prevent the SCR from false triggering.

This power supply works very nicely with my 30-Watt KLM amplifier and my ICOM Model IC-2AT. ■

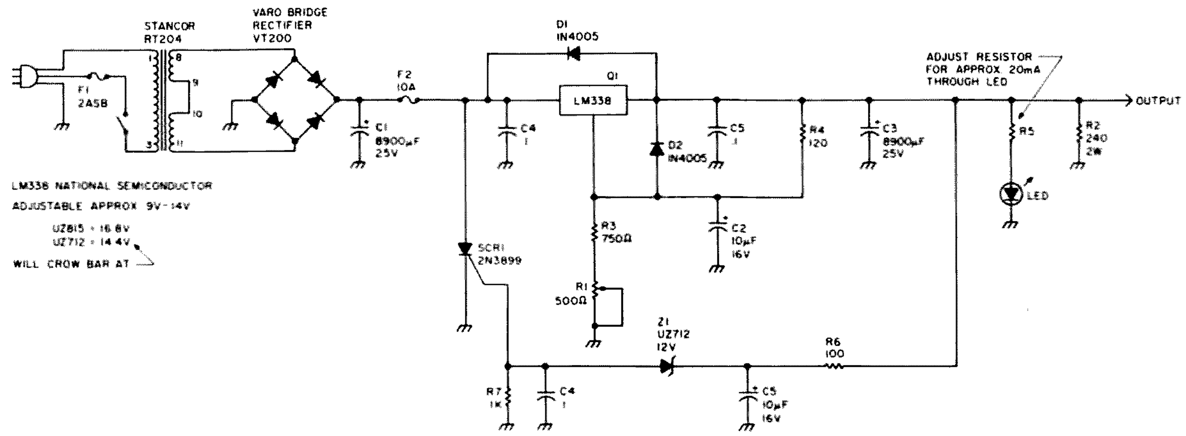


Fig. 1. 12-V-dc power supply with crowbar protection.

What You See Is Where You're At

Tired of guessing your frequency? Resolve your problem to 100 Hz with this add-on digital display.

Thomas M. Miller WA8YKN
936 Belmont Avenue
Mansfield OH 44906

The modern generation of amateur-radio transceivers is fascinating, replete with features undreamed of only a few years ago. Like most hams, I'm fond of bells and whistles, but rather than rushing out to buy the latest gadget, I enjoy studying these features to learn "how it's done," then incorporating them into my existing equipment. The main rig here at WA8YKN is a Ten-Tec Argonaut. Over the years, this little "QRP" rig has grown a 500-Watt amplifier, an internal CW filter, a speech compandor, transverters for VHF and UHF, and probably the most useful of modern features, the digital frequency display.

Like many transceivers, the Argonaut has a 9-MHz i-f. Whatever frequency is received must be mixed with the signal from the vfo to produce 9.000 MHz. For example, when tuned to 7.1250 MHz, the vfo is running at 16.1250 MHz. It's evident that all we need here is a four-digit frequency counter to display .1250 and we can find our way around the band with 100-Hz accuracy. The most significant digits (MSD), 1 and 6, are not displayed, so no mental arithmetic is required. After all, we can remember what *band* we're on!

Unfortunately, not all intermediate frequencies are nice round numbers. Suppose the i-f were 455 kHz: The display described above would read .5800 when tuned to 7.1250. Not too useful, is it? To solve this problem, the counter circuit allows presetting of each digit. This way, any i-f can be accommodated by programming the proper offset into the display. The result is a very simple and inexpensive device which can easily be added to many transceivers and receivers. The only hitch is that the vfo must tune in the same direction as the desired frequency. If the direction of your tuning knob changes from band to band, I'm sorry. This one's not for you. Everybody else, read on!

There must be millions of inexpensive general-coverage receivers out there with good sensitivity, and these receivers perform very well for casual shortwave listening. However, all of these share a common drawback: the terrible "slide-rule dial," which makes it impossible to resolve the frequency being tuned with any degree of accuracy. The addition of a digital display to an older general-coverage receiver such as the Radio Shack DX-160 makes it a much more valuable device for many ham-shack uses, as well as enhancing normal shortwave listening.

Circuit Description

The circuit uses "LS"-type TTL integrated circuits throughout for low cost and simplicity. A 7400 serves as a 1-MHz oscillator, with three 7490 divide-by-ten stages producing a 1000-Hz clock. This signal feeds a 7493 di-

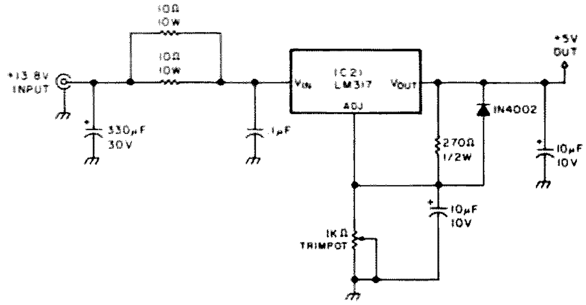


Fig. 1. Power supply.

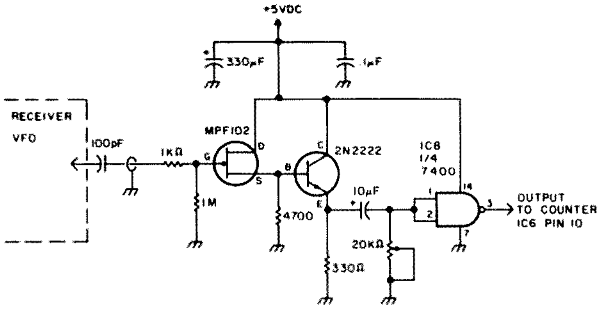


Fig. 2. Input circuit.

vide-by-twelve stage, which with a few supporting gates produces the count, latch, and reset signals. The count window is ten milliseconds long, giving 100-Hz resolution.

Each decimal counting unit (DCU) is made up of three integrated circuits and a seven-segment LED display. The heart of the DCU is the 74196 counter. Similar to the 7490, this IC is a decade counter. However, the 7490 can only be reset to zero or nine, while the 74196 can be preset to any number by placing the binary equivalent on the preset inputs and pulling pin 1 low. Small four-pole DIP switches are used to select the preset number. With all four switches closed, the display will read zero. Binary A-B-C-D is weighted 1, 2, 4, and 8. To select 5, for example, A (1) and C (4) would be switched "open."

The outputs of the counter go to the latch, a 7475, where the binary number is stored while the counter is reset and starts another count cycle. The latch signal on pins 4 and 13 of the 7475 goes high for 1 millisecond at the end of each count window, loading the resulting number from the counter to the display. A low on pins 4 and 13 freezes the outputs.

Converting the binary-coded number into a seven-segment format for display is handled by the 7447 decoder-driver IC. The seven outputs drive a common-anode LED display through seven resistors (330 Ohms each) to limit the current through each segment to about 15 milliamps.

Four DCUs are built. The reset and latch signals go to all four DCUs in parallel, but the vfo signal being counted only goes to the first counter, the one displaying the hundred-Hertz digit. The "D" output (pin 12) of this counter drives the input (pin 8) of the next *counter, and* so on.

The four-digit display gives the Argonaut 100-Hz resolution.

If the display is going to be used on a general-coverage receiver, it may not be necessary to read to one hundred Hertz. If you don't need this much accuracy, just omit the latch, driver, and readout for this digit. The 74196 counter must remain to eliminate the "plus or minus one digit" error, maintaining the display accuracy.

The input circuit has three important functions: It presents a high input impedance to avoid loading down the vfo, it amplifies and squares the waveform for counting, and it also isolates the vfo from any digital noise generated by the display itself.

Three circuits were built before the one presented here was selected. It gives good performance with the minimum parts count. When a TTL gate is fed through a capacitor, the input tends to drift high and "lock up." To prevent this, a 20k pot is connected from the input of the 7400 gate to ground and adjusted for the desired sensitivity. This is a very broad adjustment and, once set for the signal level of the vfo, will cover the high-frequency spectrum with no further attention.

The display requires five volts at just under one Amp. Since the Argonaut has 12 V dc available at the accessory jack, a simple series regulator was built using an LM317. The power is supplied to the regulator through two paralleled 10-Ohm, 10-Watt resistors which dissipate about half of the excess voltage. The regulator itself is mounted on a heat sink on the rear of the display. Neither the resistors nor the regulator gets too warm, but ventilation should be provided over the resistors.

The power supply in the DX-160 receiver would not handle any additional load, so for that display the regulator was fed from the same 13.8-volt bench supply that powers the Argonaut. The three-digit version only draws 600 milliamps.

Construction

Nothing is critical in this circuit, and the prototypes were built on 6" × 8" perfboard and wired point to point. 18-gauge bare-wire buses were run across the board from +5 volts and ground. Sockets can be used if you like. I didn't use sockets and had to replace a defective chip the hard way.

Although the circuit looks complicated, it can be built in several simple "blocks." The power supply, clock, control logic, and each DCU can be wired and checked

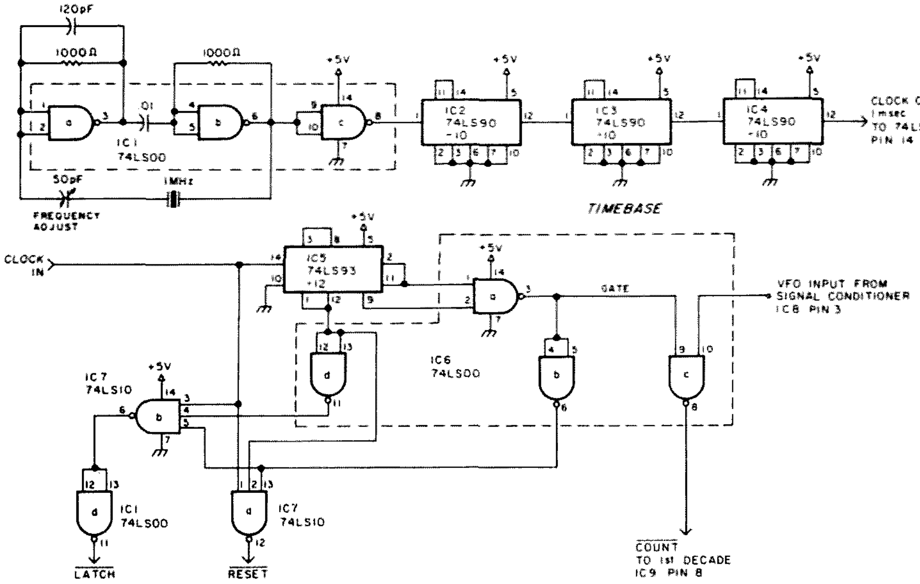
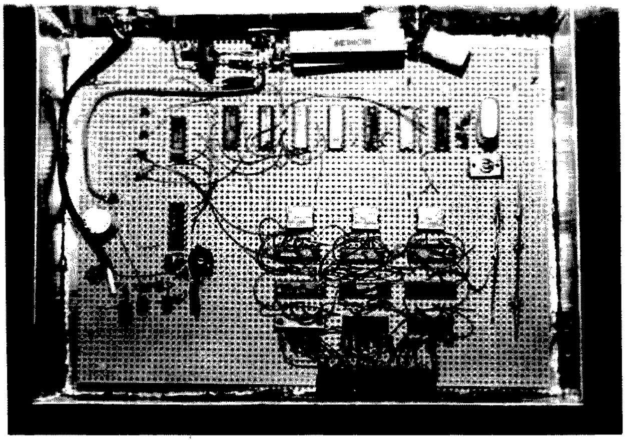


Fig. 3. Control logic.



Inside the three-digit version. The voltage regulator is mounted on the back wall of the cabinet on a sheet-aluminum heat sink. In the center, DIP switches are preset for 545 kHz.

The slide-rule dial on the DX-160 is used only to determine the frequency to the nearest megahertz. The simple three-digit display resolves to 1 kHz.

out individually. A scope is most useful for checking proper operation of the clock and control circuits. Also, a digital voltmeter is handy to set the regulator between +4.9 and 5.1 volts.

The displays were mounted at a right angle to the board, making a low-profile unit which can be placed on top of the transceiver or receiver.

In the interest of good shielding, the frequency display was housed in a box made of copperclad fiberglass circuit-board material, soldered at all seams. RCA jacks were used for power and vfo inputs. The opening for the LEDs was made with a Radio Shack nibbler tool, which cuts the PCB material nicely. The perfboard was mounted in the enclosure on one-inch-long 4-40 bolts and plastic-tube standoffs. The enclosure was painted and stick-on rubber feet were placed on the bottom. A piece of red tinted plastic was cut slightly larger than the opening for the displays and taped to the inside. I found school notebook dividers in see-through colors at the local K-Mart (39 cents each) and the red ones were perfect.

Tapping into the vfo output with a 100-pF capacitor caused only slight pulling of the oscillator, and no ill effects resulted. If your particular vfo has less output, a slightly larger coupling cap may be required. Use the smallest capacitor that will give enough signal to drive the display. An RCA jack was mounted on the back of the Argonaut chassis for the vfo output. Be sure to use good shielded cable here, and keep it short. Also, if your rig is tube-type, be sure the voltage rating of the capacitor is adequate!

The timebase can either be aligned with a frequency counter or by setting a harmonic to zero-beat with WWV.

Most vfo's have a fairly constant output through the tuning range. If yours varies much, tune it to the frequency where the output is weakest (usually the high end) and adjust the 20k trimpot on the input gate until the display starts reading the vfo frequency. That's all there is to it.

All that's left now is the i-f offset. If you have an even i-f (like 9.0), just set all the DIP switches closed. If you have another i-f such as 455 kHz, then you must program the offset into the counter presets.

Let's use the common 455-kHz i-f as an example. If

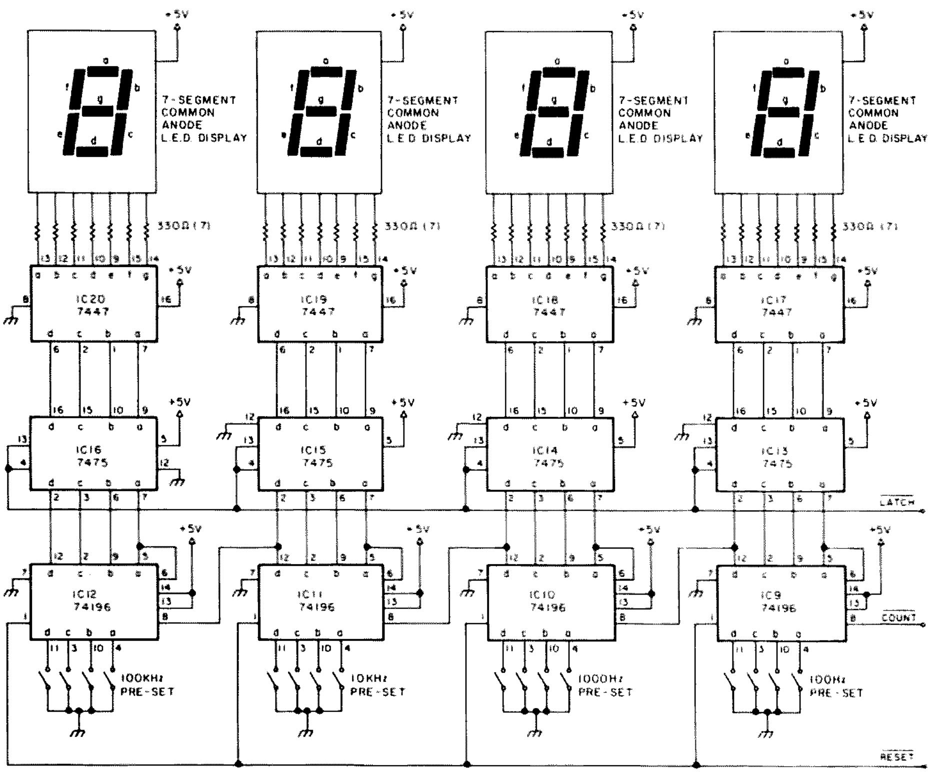


Fig. 4. Counter and display logic.

the vfo reads out on the display 455 kHz *lower* than the received frequency, you must program 455 kHz into the counter. Find the DIP switch for the left-most digit (100 kHz) and open the switch for binary C (pin 3 on the 74196). On the next digit (10 kHz), open the switches for binary A and C (pins 4 and 3 on the 74196). The next digit is also a 5, so it also gets switches A and C opened. The switches for the hundred-Hertz digit are all closed. The counter will now start each count period from 455 kHz, in effect adding that number to the count.

But what if your vfo runs 455 kHz *above* the incoming frequency (most of them do)? Just subtract 455 from 1000 and program the result (545 kHz, in this case) into the switches as described before. The counters will actually be displaying one MHz higher than the frequency we are tuned to, but since we don't display the MHz digit, we never notice.

There are several reasons for using discrete TTL ICs instead of a single-chip LSI counter. TTLs are cheap. Everything required to build this digital frequency display can be ordered from Circuit Specialists for under $35.00. (Circuit Specialists, Inc., PO Box 3047, Scottsdale AZ 85257.) Also, TTL counters work well to around 40 MHz, and most single-chip counters quit cold around 10 MHz, requiring prescaling.

Another advantage to building with discrete devices is the ease of modification to fit your requirements. Want 10-Hz or even 1-Hz resolution? Just add a few more divide-by-ten stages to the clock and switch select the resolution you want (be prepared to see your vfo drift, however). If you don't need the i-f offset feature, you could use 7490s in place of the 74196 counters. The pinout is different, of course, and the reset signal will have to be inverted, but it will be slightly simpler and cheaper.

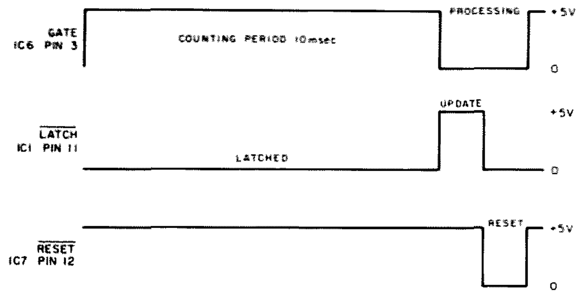


Fig. 5. Control timing diagram.

It is also possible to build two more decade counting units and display the entire frequency, including the megahertz digits. I didn't do this since the original dial was adequate for that purpose, and the primary goal was a frequency display that provided precise tuning with simplicity and minimum cost.

Using the Argonaut with the frequency display has been a joy. RTTY mailboxes are a snap to find, and it's now simple to "QSY up ten" without getting lost. Shortwave listening on the DX-160 has also taken on a new dimension. It's now possible to make accurate loggings of clandestine "spy" stations, press-service RTTY, military communications, and literally thousands of other fascinating signals. The DX-160/frequency display combination gives the type of performance previously reserved for receivers costing hundreds of dollars more.

So try the digital frequency readout on your rig. You don't have to envy the new kilobuck rigs for their bells and whistles! Build your own. ■

Parts List

IC1, IC6, IC8	74LS00
IC2, IC3, IC4	74LS90
IC5	74LS93
IC7	74LS10
IC9-12	74LS196
IC13-16	74LS75
IC17-20	74LS47

4 Common-anode 7-segment displays

Resistors

29 330-Ohm, 1/4-Watt
3 1000-Ohm, 1/4-Watt
1 270-Ohm, 1/4-Watt
1 4700-Ohm, 1/4-Watt
1 1-M, 1/4-Watt
2 10-Ohm, 10-Watt

Trimpots

1 20k
1 1k

Capacitors

1 10-uF, 10-V-dc
1 100-uF, 30-V-dc
1 330-uF, 30-V-dc

1 50-pF ceramic trimmer capacitor
1 LM317 voltage regulator
1 1-MHz series-resonant crystal
4 4-pole DIP switches

Miscellaneous items: RCA jacks, perfboard, materials for enclosure, wire, solder, mounting bolts, etc.

All parts are available from Circuit Specialists, Inc., PO Box 3047, Scottsdale AZ 85257.

Allen J. Wolff KC7O
57W Grand View Ave.
Sierra Madre CA 91024

There and Back Again

Add band-scanning to your TS-930S for under $20.

I purchased the new Kenwood TS-930S in December, 1982. It is a fine radio and, after some initial problems, has performed as advertised. After hearing of the features of the TS-430S and playing with one, there was one function not included in the TS-930S that made me jealous. That was the scanning feature. On the TS-430S you can program memory channels 6 and 7 and scan between them.

The existing up-scan or down-scan built into the TS-930S is virtually useless. It starts slowly and after 3 seconds speeds up so that it is useful only on the international broadcast or the AM broadcast bands where the bandwidths of the stations are very wide. It goes through single-sideband signals at a rate of knots and nothing can be heard or understood as it zips by. Even if you could discern the signals, the scan would never reset. It would go up or down until it ran out of radio spectrum and would stop at either 29.999.99 MHz or 100.00 kHz.

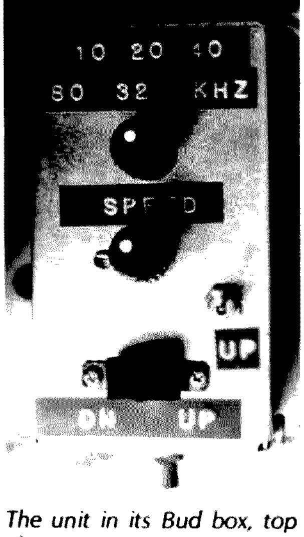
Band scan would be a desirable feature because you could monitor preset sections of a band without having to sit in front of the radio and twist the knob. You could monitor the DX portion of 20 meters for that rare one, scan the net activity on 75, or hunt through a portion of 8 MHz looking for interesting signals to pop up. All this could happen while you are in another part of the shack working on a project or writing an article.

It so happens that if you pulse the up or down control line on the TS-930S microphone connector, the radio will step at the same rate as the pulses. Each pulse moves the radio 10 Hz. For example, if you pulse the up line at a 20-Hz rate (pull the line to ground), the radio will advance 200 Hz a second. A 50-Hz pulse rate will advance the radio 500 Hz per second. With a simple 555 timer chip, a variable-speed scan rate can be achieved. Eventually, however, the radio will be out of the ham band and will happily continue all the way to 29.999.99 MHz and stop. Most unsatisfactory!

Since the TS-930S has memories and memory recall, we can put these functions to use. When we push the memory-recall button, the radio will always return to whatever frequency was programmed into the memory channel selected. If we use the above and add one function, a timer, we end up with a device that will pulse the radio along at a variable speed, determine how wide the frequency range should be, and return to a preprogrammed frequency.

Fig. 1 shows a simple way of performing the scan-recall function. The top 555 timer (IC1) is a pulse generator that pulls the up-scan line to ground at a variable rate, and the second timer (IC2) will pull the memory-recall line to ground after a user-selected time. This will reset the radio to a preprogrammed frequency. The problem with this method is that you end up with two variables, scan speed and reset time. Unless some specific preset variable resistors or capacitors were switched in for both functions simultaneously, you would never know the scan width accurately. Fig. 2 is a circuit to perform the above, but it was discarded prior to incorporation because of the inconvenience of the two variables.

What I needed was a method to count or accu-



The unit in its Bud box, top view.

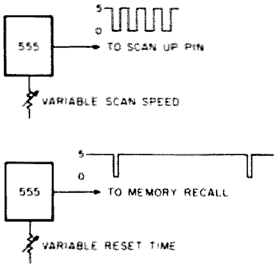


Fig. 1. Simple scan reset.

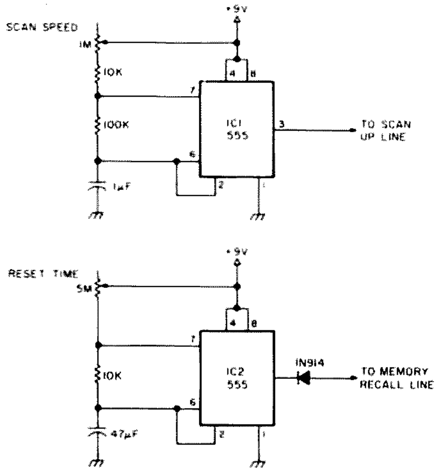


Fig. 2. Simple scan and reset circuit.

Count 2 to the	Counted Pulses	Approx. kHz	Switch Program (Pin #)* 9	10	11	12
9	512	5	0	0	0	0
10	1024	10	1	0	0	0
11	2048	20	0	1	0	0
12	4096	40	1	1	0	0
13	8192	80	0	0	1	0
14	16384	160	1	0	1	0
15	32768	325	0	1	1	0
16	65536	650	1	1	1	0
17	131072	1,300	0	0	0	1
18	262144	2,600	1	0	0	1
19	524288	5,250	0	1	0	1
20	1048576	10,500	1	1	0	1
21	2097152	21,000	0	0	1	1
22	4194304		1	0	1	1
23	8388678		0	1	1	1
24	16777216		1	1	1	1

*0 = ground; 1 = plus 9 volt.

Fig. 3. MC14536B program chart.

mulate the pulses from the 555 pulse generator. If a preset number of pulses were counted, then the scan width at 10 Hz per pulse would be determined independently of pulse speed.

The device I chose was suggested by Mike WA7ARK and Steve KE7G. It was the Motorola MC14536B programmable timer. This is a 24-stage ripple binary counter with the last 16 stages selectable by a four-bit code. (From the Motorola CMOS *Data Manual.*) It has 24 flip-flop stages and will count from 2^0 to 2^{24} pulses and then trigger, reset, and start again. Essentially it can be programmed to count from 2^9 (or 512) pulses to 2^{24} (or 16,777,216) pulses. Since each pulse represents 10 Hz to the radio, 2^9 would be 5120 Hz or approximately 5 kHz; 2^{10} would be 10,240 Hz or 10 kHz, etc. See Fig. 3 for the program and frequency information.

Fig. 4 is the block diagram of the selected design. The 555 pulses at a user-variable rate and the programmable timer uses the pulse rate as its clock. When the timer reaches its preprogrammed count, it pulses a transistor switch and pulls the memory-recall line to ground, resetting the sequence. The radio beeps each time the sequence recycles.

A final circuit is shown in Fig. 5. The components chosen provide a pulse rate between 11 and 68 Hz, which represents a 110-to-680-Hz-per-second scan range. In other words, the radio will scan a 40-kHz bandwidth in 65 to 370 seconds, depending on the scan-speed setting.

To program the scanner, a five-position 4-pole switch was handy and was pressed into service (Fig. 6). The scan widths programmed were 10, 20, 40, 80, and 325 kHz. 10 and 20 kHz are useful for looking for a schedule; 40 and 80 kHz can be used to monitor a complete band segment (i.e., advanced section of 20). Most of the international broadcast bands are between 200 and 350 kHz wide, so 325 kHz is a good compromise (13- through 60-meter bands).

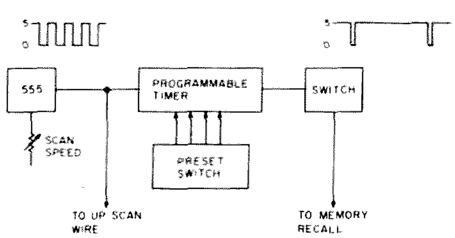
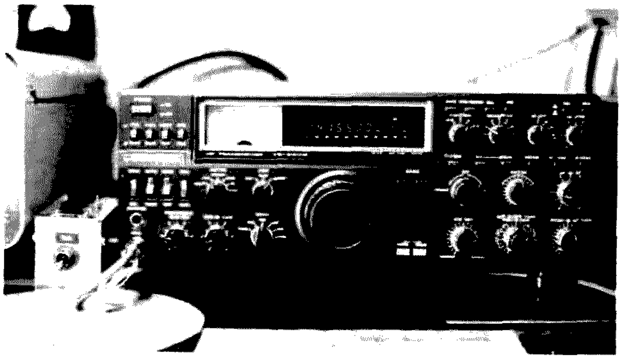


Fig. 4. Block diagram of final circuit.



The unit is at the left, front view.

Now for the bad news. (The news you suspected but did not want to admit.) The radio has to be slightly modified. To ease the pain, this modification adds only one wire. Unplug the radio and remove the top and bottom covers. Keep the radio right side up and refer to Fig. 7. If you do not have the automatic antenna tuner installed, you will easily see where you must attach the extra wire. At point X or Y, tack-solder an insulated small-gauge wire. The other end of the wire must reach the microphone connector, so leave it long. If the antenna tuner is installed, as mine is, you may want to remove it—or just reach in carefully with a small low-wattage iron and tack-solder the wire to the back of the memory-recall switch, as above.

With an ohmmeter, check between the unsoldered end of the wire and the case of the radio (ground). Verify that a short is obtained when you press the memory-recall button.

Next, snake the wire to the bottom of the radio, turn the radio over, and attach the wire to one of the two unused contacts on the microphone connector. That is the extent of the modification to the radio.

The circuit is built in a small Bud box and placed next to the radio. Three wires must be added between the microphone con-

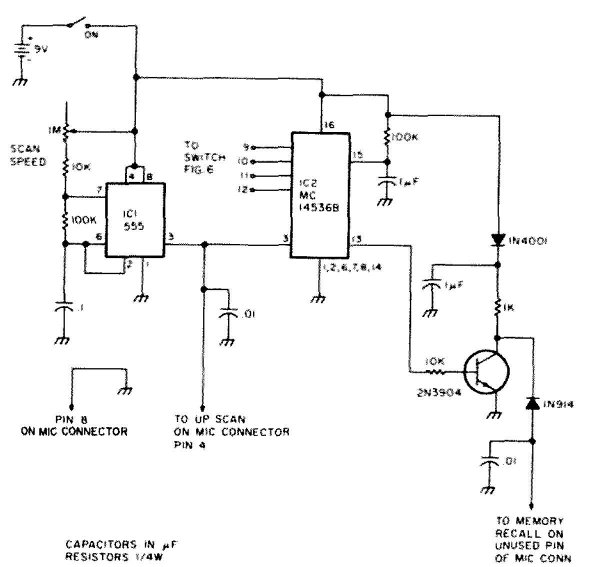


Fig. 5. TS-930S scan circuit.

nector and the scan box. They are ground, scan-up, and memory recall. Shielded wire is recommended.

The unit is powered by a 9-V transistor-radio battery and, due to the low current drain, I expect long life.

The complete circuit could have been built inside the radio, under the VOX access door on top of the radio, using the radio power. This would have been an extensive modification and I did not feel it was necessary. This circuit could also be built into a microphone stand.

I have found this modification most useful. For example, I keep a weekly schedule with Lowell W2HXJ. We meet around 14.260 MHz, plus or minus. I set the scan width to 20 kHz, preprogram the memory for 14.250, and turn the scan on. I set the scan speed to sweep through 20 kHz in about 45 seconds. I haven't missed Lowell yet, and I do not have to be near the radio to hear him call!

The circuit is simple, and the only expensive part is the programmable timer, which lists for approximately $11.00. ■

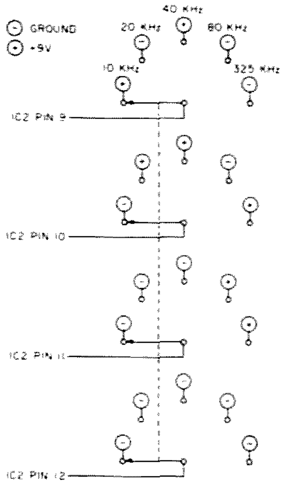


Fig. 6. Preprogrammed switch.

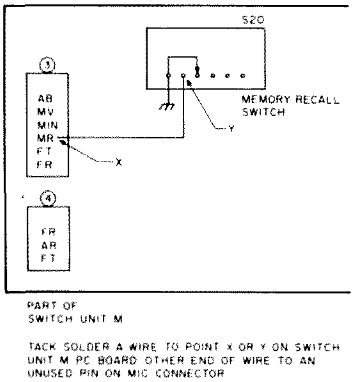


Fig. 7. Part of switch unit M.

Part List

1—555 timer	Radio Shack 276-1723	$.99
1—MC14536B Motorola	Motorola Distributor	11.00
1—2N3904	RS 276-1603	.14
1—1N4001	RS 276-1101	.25
1—1N914	RS 276-1122	.10
1—1k resistor, ¼ W	RS 271-1321	.08
2—10k, ¼ W	RS 271-1335	.16
2—100k, ¼ W	RS 271-1347	.16
1—1-megohm pot	RS 271-211	1.09
2—.01 uF	RS 272-131	.39
1—.1 uF	RS 272-135	.25
2—1 uF	RS 272-1419	.49
1—9-volt battery	RS 23-553	2.19
		$17.29

Hardware (as required): 1—4-pole 5-position switch; 1—Bud box; 2—knobs; 1—SPST switch, and 2—IC sockets.

Steve Katz WB2WIK
24 Louis Drive
Budd Lake NJ 07828

Home-Brew the Blockbuster

In a heroic effort, WB2WIK has created the ultimate 6-meter amplifier. Its single 4-1000A delivers over 2 kW with only 20 Watts in. The power supply alone weighs 120 pounds. When this monster talks, people listen!

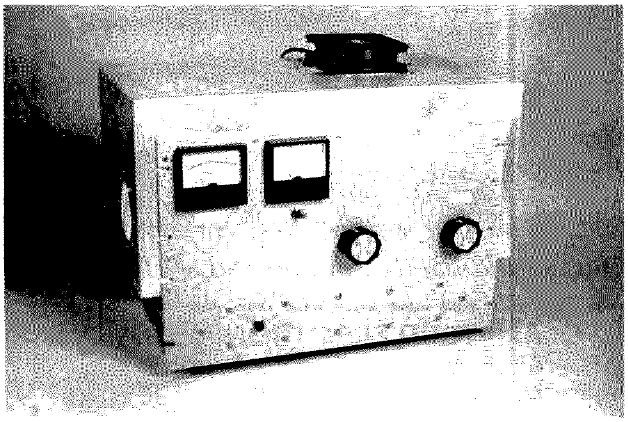


Photo A. The six-meter Blockbuster.

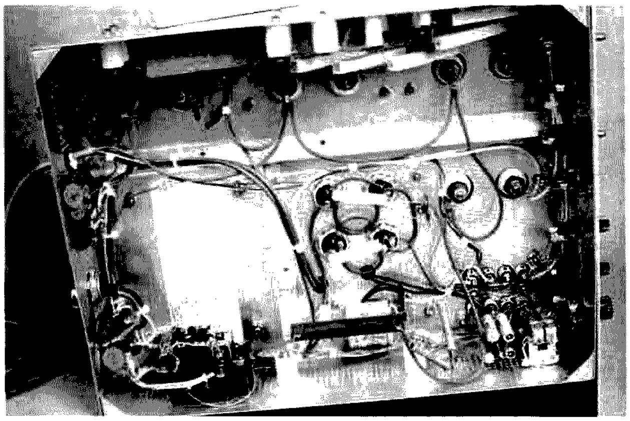


Photo B. Power supply, bottom view.

Although I enjoy rag-chewing, DX-chasing, contesting, satellite work, and just about every conceivable aspect of amateur radio, the activity I enjoy most of all is home-brewing, especially home-brewing with a purpose. This article describes a reasonably ambitious effort which was precipitated by a very distinct purpose: I wanted to become more competitive in VHF contests, especially on the 50-MHz band where a few more dB could add multipliers via meteor scatter when band conditions are less than perfect. I call the result my "Blockbuster."

I had been using a rather modest kilowatt amplifier on six meters, a single 4CX350A at about 600 Watts PEP output, and I wanted to QRO right to the legal limit of 1.5 kW PEP out. While this is only about a 4-dB increase in signal, I reasoned that it would be the most important 4 dB of all, especially in contests where scatter-mode communication is very important for added multipliers. I toyed with the idea of using such exotic tubes as 8877s, 4CX1500s, or possibly the new Eimac 3CX800, but dismissed these as too expensive or, in the case of the 8877, too hard to drive. I really wanted a legal-limit amp which could be driven with today's solid-state multimode rigs (perhaps 20 Watts PEP output) and which used an inexpensive, obtainable tube. Hmmm . . . what about the old, reliable 4-1000A?

For the uninitiated, the 4-1000A is a workhorse tetrode that has been around forever and is usable to 110 MHz despite its overwhelming stature (about nine inches tall, five inches in diameter). The plate dissipation rating is 1000 Watts and the tube can be operated in grid-driven class AB_2 service at well over the legal power limit with only 20 Watts drive. Not only that, the real charm of the 4-1000A is its availability at reasonable cost. This is a very popular broadcast-service tube and "pulls," which still will deliv-

er 1500 Watts PEP output, are offered at flea markets for about $50 to $100, a far cry from the price tag on an 8877.

My desire to operate the project amplifier in grid-driven rather than grounded-grid service was the result of careful investigation of the parametric trade-offs. A grounded-grid 4-1000A, certainly an easier amp to build, requires over 100 Watts drive and *might* deliver 1500 Watts PEP output, while a grid-driven circuit, obviously more complex, only requires 20 Watts drive and should deliver 2000 Watts PEP output easily!

Not one to flaunt all this power, especially in a national magazine probably read by FCC staffers, I'll just say that I reasoned a 2-kW+ amplifier should really sound good and should last a long time when run at the reduced legal limit of 1500 Watts.

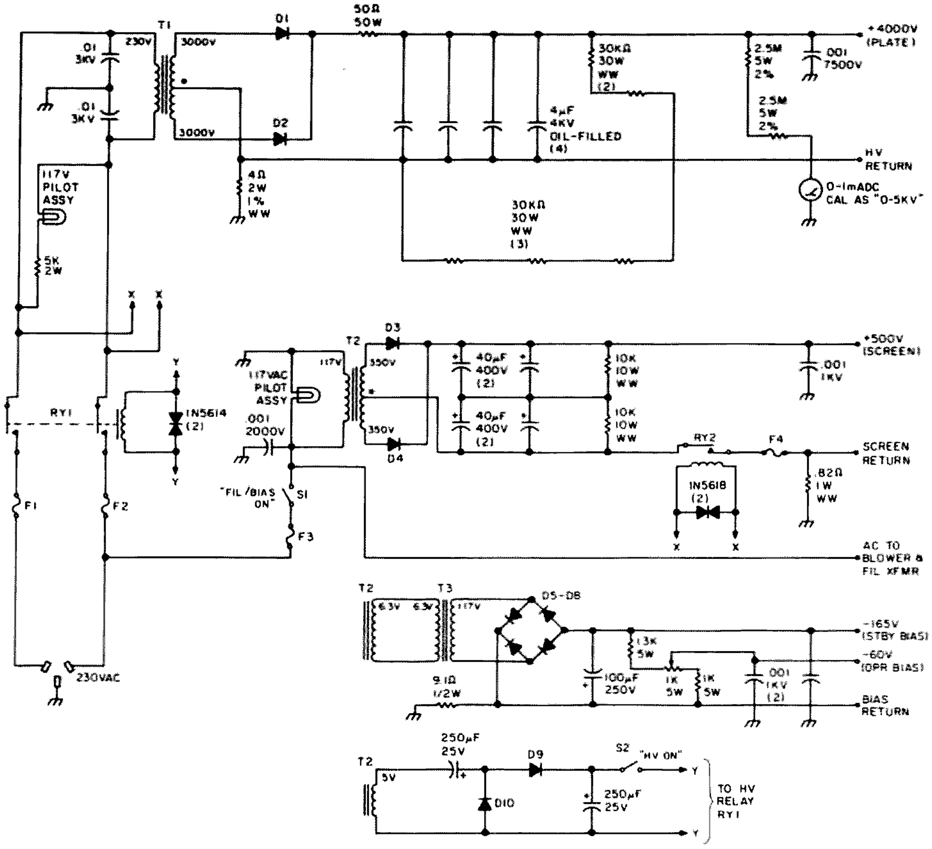


Fig. 1. Power supply.

I built the power supply first. This is a matter of personal preference, but I strongly recommend that anyone attempting this project follow my lead and tackle the power supply right off. The power supply is going to be very heavy and a mighty pain in the neck to assemble largely because of its muscle-building bulk, and if you don't finish this half of the job at the start, you might never get to it.

My power supply is actually three power supplies built on a single chassis measuring 17" × 13" × 4" and then bolted to a 12" × 19" rack panel. The aluminum chassis has perforated side walls to enhance air circulation beneath, and it wouldn't have been strong enough to support all the transformers and capacitors if I hadn't first given it additional support by means of some 3/4" aluminum angle stock riveted under the whole length and half the width—see Photo B. (My thanks to WA2VUN and W2HWG who did much of the aluminum punching, riveting, and welding on this project.)

After the power supply was completed, I added more 3/4" aluminum angle stock between the rear of the chassis and the back side of the panel to add support and also to give me a place to grab when attempting to lift this turkey! My supply weighs 120 pounds, but possibly yours can be somewhat lighter if you choose less bulky components.

Because I know the 4-1000A is both voltage- and current-hungry, I designed the plate supply to deliver 4000 volts at one Ampere. This may sound like overkill, and maybe it is, but I wanted this thing to last through a lot of contests. I bought a Hypersil transformer from the Peter W. Dahl Company (El Paso, Texas) for something over $200. Its ratings are 6000 volts center-tapped at 800 mA CCS, and it weighs about fifty pounds. Careful shopping at flea markets might possibly turn up something similarly rated for less money.

I run the plate supply as a full-wave center-tap using two 7500-volt, 2-Amp rectifier stacks and 16 uF of filtering (4 each, 4 uF at 4 kV). The high-voltage capacitors are large but weren't expensive—obtained from Fair Radio Sales (Lima, Ohio) via mail order. The plate-supply bleeder is a bank of five 30k-Ohm, 30-Watt wire-wound ceramic resistors mounted on ceramic standoffs. The plate transformer, needless to say, is supplied by a "stiff" 230-volt-ac line and the primary is dual-fused (each side of the 230-volt line) with 20-Amp slow-blow fuses and switched with a 25-Amp DPST relay.

The screen supply delivers 500 V dc at 100 mA and is so stiff it requires no additional electronic regulation. I used a multi-winding transformer obtained from Fair Radio Sales. The 700-volt center-tapped secondary drives a full-wave (center-tap) rectifier circuit followed by a 70-uF filter and a 20k-Ohm bleeder and delivers almost exacty 500 volts of low-ripple dc. The screen transformer center-tap is also relay-switched to ensure that the plate supply is on *before* the screen supply. Catastrophic results are likely otherwise.

The power supply also contains the grid-bias supply, which delivers two output voltages: −165 V dc for standby and −60 V dc, adjustable plus or minus 20%, for operating. I derive the bias from a full-wave bridge rectifier driven by a 6.3-V filament transformer which is wired back-to-back across a 6.3-V-ac winding of the screen transformer. The

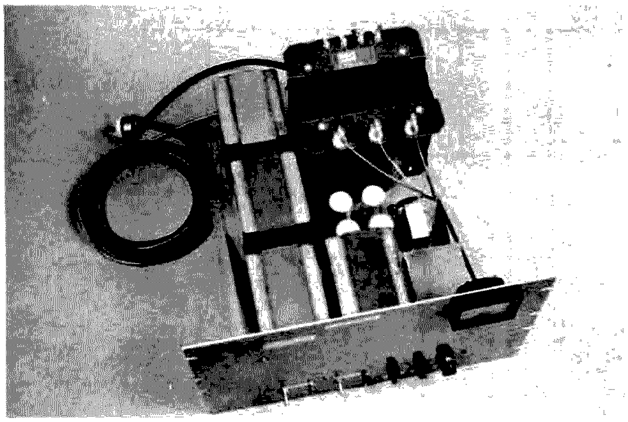


Photo C. Power supply, top view.

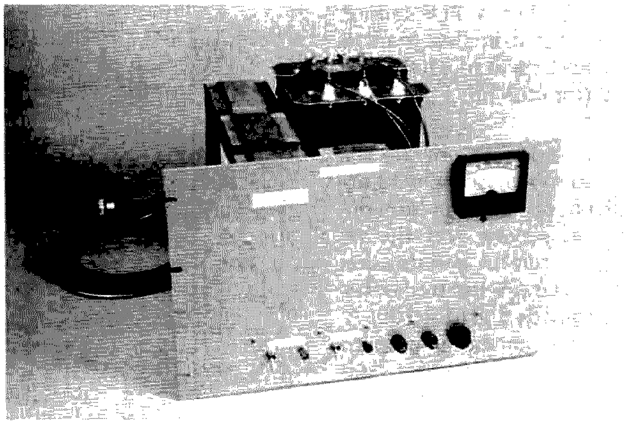


Photo D. Power supply, front view.

117-volt-ac drive to the bridge yields −165-V-dc output, filtered by a 100-uF, 250-V capacitor. The bleeder-resistor-string values were chosen to make a voltage divider which sets the adjustable operating bias in the range required for a 4-1000A in class AB_2.

The high-voltage (plate) transformer is switched (as mentioned) by a large relay whose coil is driven by a little 12-volt-dc power supply built into the system for just this purpose: I made this 12-V-dc supply by voltage-doubling a 5-V-ac winding which happened to be another secondary of the screen transformer (I told you this was a multi-function unit!). The ripple and regulation of this supply is unimportant since its only load is a relay coil. I use the plate-transformer primary to drive the screen relay, thus ensuring that the plate supply is on before the screen supply. This is a good safety measure because tetrodes get very excited about having screen voltage before plate voltage (it destroys the screen).

My supply has a built-in plate voltmeter (0–1-mA-dc meter driven by a series-multiplier string of five one-megohm resistors) which reads 0–5000 volts dc. This is a useful scale since the key-up voltage is 4500 V (key-down is about 4100 V). The supply also contains shunts for plate-current, screen-current, and grid-current meters which are mounted on the panel of the rf deck. These are all indicated on the schematic diagram for the power supply (Fig. 1).

I also have a "keyed" 117-V-ac output line coming from the power supply to the rf deck to run the deck-contained blower, filament transformer, and pilot lamp. The power supply contains two pilot lamps (ac on and HV on) plus several fuse assemblies. All ac inputs, ac outputs, and dc outputs are bypassed with suitable ceramic capacitors as indicated on the schematic. The 4-kV plate-supply output is bypassed with 7.5-kV "doorknob" capacitors since not many other types will withstand this kind of voltage continuously.

At this power level, even the ac line cord must be se-

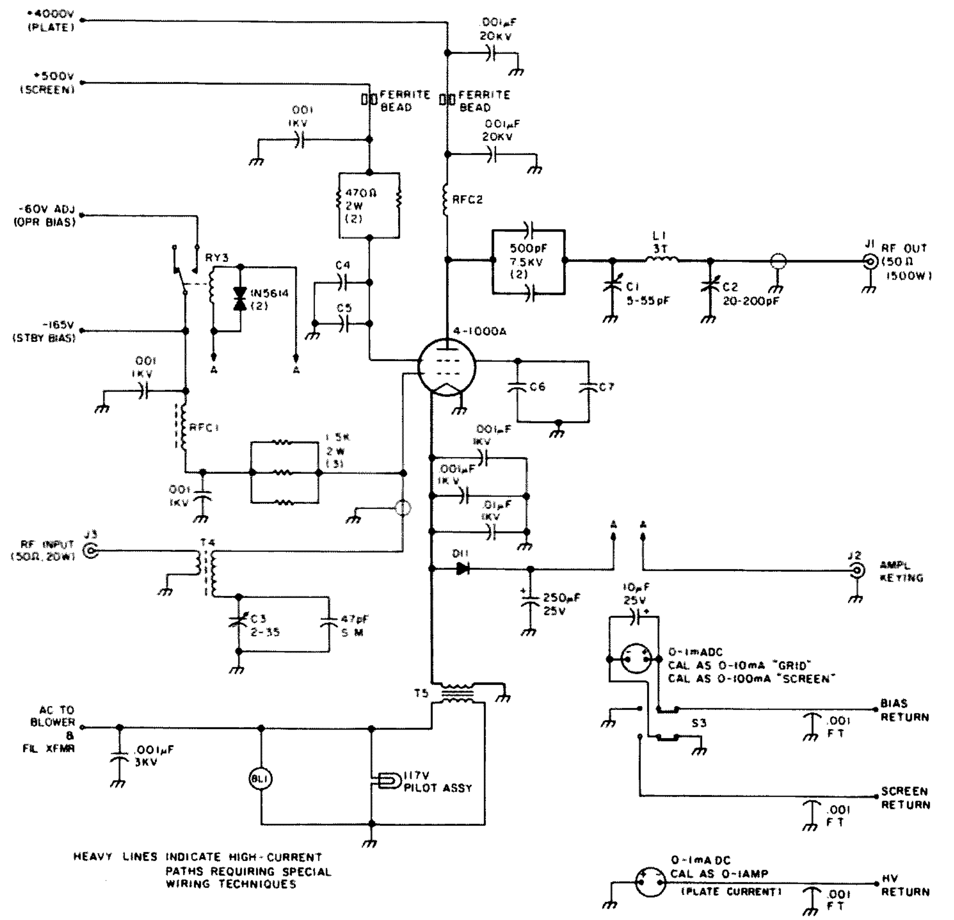


Fig. 2. Rf deck.

lected carefully—I used a #12-4 cable. A smaller cable will have too much IR drop. Remember, this is a 4000-Watt power supply! I run the switched ac *and all* low-voltage dc lines through a 12-conductor cable to a Cinch-Jones-type power connector which mates with another connector fitted to a similar cable coming from the rf deck. The HV output line is made of 20-kV anode cable fitted with a male Millen-type high-voltage connector at each end.

The completed power supply is not a table-top unit by any means, but it is quite compact for its capability and is attractive enough. The commercial look is imparted by careful construction and good overall workmanship. Wire dress, especially at the 4-kV level, is very important! All plate-supply secondary wiring is 20-kV insulated anode wire.

The rf deck is straightforward. I designed the plate tank circuit for a Q of about 16. A *lower* Q is not possible with the 4-1000A at 50 MHz because of the tube's high plate capacitance. The tank circuit, a conventional pi network, uses a Jennings vacuum-variable input-tuning capacitor, type GCS-55, a coil made of ¼" copper tubing (3 turns, 1¾" inside diameter, 3¼" long) and a 200-pF air-spaced variable-output capacitor made by E. F. Johnson (type 167-12). The Jennings plate-tuning capacitor is rated at 7500 volts, and this is a recommended unit. It has high Q and very low minimum capacitance, which is required at this frequency. If a Jennings unit cannot be found at reasonable cost, I'd recommend a Millen-type 15011 neutralizing capacitor with 2¼"-diameter plates as a second choice. The object here is high Q and very low minimum C in order to obtain a reasonable overall Q. An ordinary air-spaced variable multi-plate capacitor won't work.

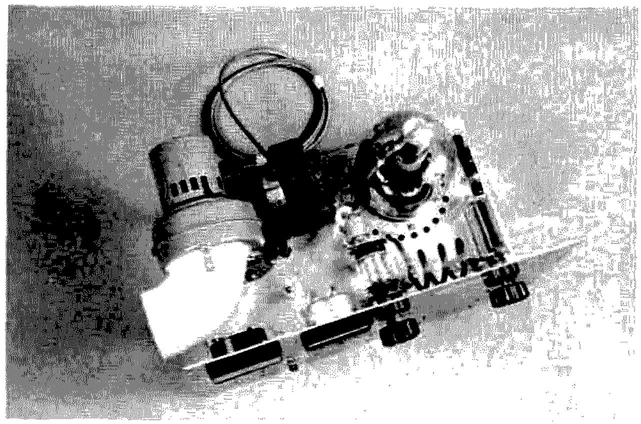


Photo E. Rf deck, top view.

While chassis size for the rf deck is certainly not critical, the deck must be fairly large simply because the 4-1000A is so darned big! My chassis measures 10" × 17" × 4" but could be slightly smaller if the blower were mounted totally outboard. I used an Eimac SK-510 socket, but this shouldn't be critical, as any air-system socket will work fine. These sockets do *not* contain any special screen-bypass capacitor and are of simple construction and low cost. While Eimac and others recommend the use of a glass chimney for the 4-1000A, I didn't use one. Instead, I punched 24 5/16"-diameter holes in a circle pattern around the outside of the socket rim (see Photos E and F) and forced a lot of air through the socket and these holes, thus creating a considerable draft along the tube envelope. The blower I selected was a Dayton 2C781 (Photos E and F), but any similar or larger blower will work. The object, obviously, is to force a *lot* of air through the tube base and around the envelope. The more air, the better! I also used a large (1-3/8" diameter) finned aluminum-plate cap on the tube to help reduce plate-seal temperature.

Since the rf deck chassis must be pressurized, use one with solid, not perforated, walls. Also, be sure to seal any cracks or holes with RTV caulking compound to help maximize pressurization of the under-chassis.

My rf deck has the filament transformer mounted atop the chassis between the blower and the tube. It might be wiser to mount the transformer below the chassis, as the heat radiated by the 4-1000A adds to the operating temperature of the transformer. I used a filament transformer from Amp Supply Company (Twinsburg, Ohio), type X7.5-21, which cost about $50. I also obtained several other components, like some 7500-V doorknob capacitors, panel meters, etc., from Amp Supply. Since the 4-1000A filament drain is very high, the wiring must be kept short and the conductor size large. I used #12 insulated wire routed directly to the tube socket.

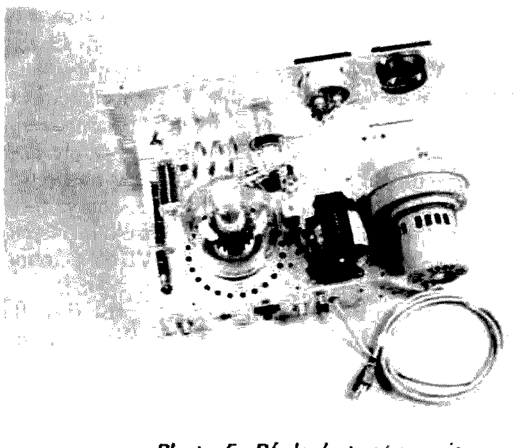


Photo F. Rf deck, top/rear view.

The input-circuit and plate rf-choke designs were borrowed originally from an *ARRL Handbook* article written around a 4CX1000A amplifier for six meters; however, both items required modification for use with the 4-1000A. The 4-1000A and 4CX1000A, while very different tubes, have similar input capacitance and I reasoned that the *Handbook* circuit would work. It didn't, and I modified both the tuning capacitance and the grid-load resistance to accommodate the 4-1000A characteristics. These revisions are noted in the rf-deck schematic diagram (Fig. 2). Having built other VHF high-powered amplifiers, I already knew something about plate rf chokes and the *Handbook* design, using a 1"-diameter Teflon™ form, looked good. It worked, but flamed out after a few hours of operating time. I rewound the plate rf choke using #20 enamel wire on the same Teflon form and so far this choke has lasted. It is likely that the combination of very high rf voltage across the choke, the considerable dc current through the choke, and its very high ambient temperature (the result of its being located close to the 4-1000A envelope) caused the demise of the original component—which was wound with #24 wire.

The input circuit, shown in both photos and figures,

centers around a single T50-12 ferrite toroid transformer. I obtained both this toroid form and a supply of ferromagnetic beads for decoupling purposes from Amidon Associates (North Hollywood, California), who are very nice people to work with and offered me overnight delivery at reasonable cost.

The plate-blocking capacitor is actually two paralleled 500-pF, 20-kV doorknob units made by Sprague and purchased at a local flea market. The 20-kV rating is unnecessary, but I'd strongly recommend the doorknob design; other types of capacitors just can't handle all the rf current.

The output-circuit configuration and mounting is straightforward as pictured in Photo F. The Jennings vacuum capacitor mounts on three aluminum spacers directly to the front panel, while the tank inductor and loading capacitor mount on ceramic spacers to the chassis. Interconnections between all plate-circuit components are made with copper braid taken from high-quality RG-8/U coaxial cable. The connection from plate tank to the rf-output connector, a type-N receptacle, is made with high-quality RG-8/U routed as far away from the tube envelope as possible to avoid overheating. After all, with this amplifier at maximum output, the rf voltage across the 50-Ohm output cable is about 450 volts peak when the output load swr is 1:1 and can become considerably higher at elevated vswr. The output current is also high in this legal-limit amplifier: About 6.5 Amperes rms will be conducted in the output cable. Needless to say, RG-58/U—even in very short lengths—is *not* recommended!

I used knobs from an old Heathkit SB220 for the plate tune and load controls. The front panel of the rf deck would look a bit boring with just two knobs, so I fancied

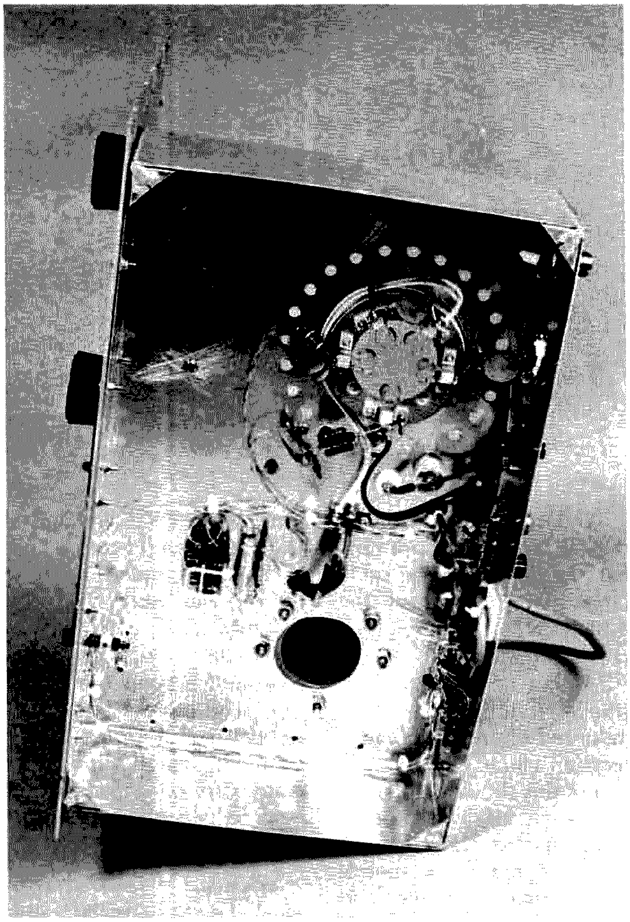


Photo G. Rf deck, bottom view.

it up a bit with a pair of 3¼" panel meters, a meter switch, and a red pilot-lamp assembly to indicate the "on" status of the remote power supply. The right-hand meter reads 0–10 mA dc for grid current and 0–100 mA dc for screen current and is switched with the toggle switch mounted directly below the meter. The left-hand meter monitors plate current and reads 0–1 Ampere dc. My initial testing of the amplifier was performed *sans* rf-deck cabinet (although the bottom cover plate for the chassis must be in place) and I originally intended to look for an old 75A2 cabinet or something to mount the rack panel to and create an enclosure. WA2VUN fabricated the cabinet shown in his welding shop, however, and it is quite functional.

A *large* hole must be punched in the cabinet above the 4-1000A to allow free escapement of the cooling air which is forced past the tube. This hole should be at least five inches in diameter and centered directly over the tube. The ventilation hole should be covered with window-screen material or the like to aid in shielding. This amplifier is bound to create a TVI problem, especially in areas with Channel 2 service, whether it is well shielded or not, but proper shielding combined with good power-supply decoupling and an outboard low-pass filter in the antenna feedline should at least help reduce TVI to a manageable level.

When building the rf-deck cover, be sure to allow an adequate air-flow path for the blower *intake* as well as the exhaust. Mine is ducted from the side of the cabinet away from the tube to ensure a plentiful supply of cool intake air. While an outboard blower would solve this problem, I intended the deck to be as self-contained as possible without occupying too much depth on the operating bench; I mounted the blower on the rf-deck chassis and ducted the air intake to the cabinet side wall using an elbow made of 3" (inside diameter) PVC tubing.

My first attempt at putting this monster on the air revealed a few weak links, some of which I discussed earlier. One weak point not yet mentioned is the grounding strap which connected the rotor of the plate-loading (output) capacitor to chassis ground. I had built this strap of RG-8/U braid which was soldered to a rotor lug on the 200-pF capacitor and bolted to the chassis. After a few minutes of key-down operation at about one kilowatt output, the solder bonding the braid to the rotor lug melted, disconnecting this ground point and throwing the tank circuit out of resonance. Apparently there are some real hefty circulating tank currents in this amplifier (partially due to its high Q) and solder was not going to do this job!

Adding a parallel ground path, using some .031"-thick aluminum-sheet material, *bolted*, not soldered, between the capacitor rotor connection point and the chassis solved this problem. I bent some sheet aluminum to make a bracket-like assembly and punched it to accommodate the load-capacitor shaft bushing (which is electrically common to the rotor) and then bolted this assembly to connect the capacitor rotor to the rf-deck chassis. This seems to have permanently solved the ground-braid overheating problem.

At this point, I was able to drive the Blockbuster to a good, solid 1500 Watts rf

Parts List

Note: Unless otherwise specified, all resistors are 1/2 Watt, 10%; all capacitors of less than 1 uF are disc ceramic, 1000 Volts. Many values are not critical and may be substituted, as discussed in the text. Other key components are discussed in the text.

BL1	Centrifugal "squirrel-cage" blower	Dayton P/N 2C781 or equiv.	$20
C1	Plate-tuning capacitor	ITT/Jennings P/N GCS-55 or equiv.	$15 surplus $100 new
C2	Plate-load capacitor	E. F. Johnson P/N 167-12 or equiv.	$5 surplus
C3	Input-tune capacitor	All-Star Products P/N APC-5814 or equiv.	$5.95 new
C4–C7	Screen-bypass capacitor	Centralab P/N DD30-102 or equiv.	59¢ each new
D1, D2	HV rectifier assembly	Semtech P/N SCHS7500 or equiv.	$54.74 each new $10 each surplus
D3–D11	Rectifier, 1000 piv, 1 A	Semtech P/N 1N5620 or equiv.	$1.51 each
F1, F2	Primary line fuse	Bussmann MDL20 or equiv.	25¢ each
F3	Screen/bias/blower fuse	Bussmann MDL5 or equiv.	25¢ each
F4	Screen center-tap fuse	Bussmann AGC1/8 or equiv.	80¢ each
J1	Rf output receptacle, Type N, Mil type UG-58A/U	Amphenol P/N 82-97 or equiv.	$3.29 each
J2	Keying receptacle, RCA phono type		20¢ each
J3	Rf input receptacle, UHF type, Mil type SO-239	Amphenol P/N 83-1R or equiv.	89¢ each
L1	Plate tank coil, 3 turns 1/4" copper tubing wound on a 1-3/4" form (which is then removed), 3-1/4" long		Home-brew $1
RFC1	2.5-uH, 1-Amp choke	J. W. Miller P/N 4606 or equiv.	$1.95
RFC2	36 turns #20 enameled wire on 1"-diameter Teflon™ rod		Home-brew $5
RY1	DPST or DPDT relay (plate supply primary), 20-Amp, 230-V-ac contact ratings	PRD P/N 7DY0 or equiv.	$12.95 new
RY2	SPST or SPDT relay	P&B P/N KA5AG or equiv.	$5.95 new
RY3	SPDT or DPDT relay	P&B P/N KA11DG or equiv.	$6.95 new
S1, S2	SPST or SPDT toggle switch	Cutler-Hammer P/N 7580K7 or equiv.	$1.59
S3	DPDT toggle switch	Cutler-Hammer P/N 7591K6 or equiv.	$1.79
T1	HV (plate) transformer, 230 V ac: 6000 V ac center-tapped, discussed in text.		$230 new
T2	Multipurpose transformer, 120 V ac: 700 V ac center-tapped, 6.3 V ac and 5 V ac	Fair Radio P/N T52960 or equiv.	$5.95 (surplus)
T3	Filament transformer (used for bias), 120 V ac: 6.3 V ac @ 2 Amps	Stancor P/N P6466 or equiv.	$6.95 new
T4	Rf input transformer (toroid), 2 turns #24 enameled wire primary, 10 turns #24 enameled wire secondary, wound on a T-5-12 core. Observe winding polarity.		Home-brew $1

output into my 50-Ohm Bird oil-cooled dummy load. The exciter power required for legal-limit output is only 25 Watts, yielding an amplifier power gain of 60. This amplifier is very linear, so the 60:1 power gain remains nearly constant over a wide range of driving powers; e.g., 20 Watts drive yields 1200 Watts output, 10 Watts drive yields 600 Watts output, etc. My own six-meter exciter achieves only about 25 Watts peak output, so my station is held down to the legal-limit power level by virtue of drive limitations.

Using WA2VUN's ICOM IC-551D, which can develop about 80 Watts peak output power, I was able to drive the Blockbuster to considerably beyond legal output power. Even at 1.8 kW CCS output, the 4-1000A draws no grid current at all and the plate color is a bright but entirely reasonable shade of red. I don't recommend running this power level for two very good reasons: (1) It exceeds the plate dissipation rating of the 4-1000A—and this will undoubtedly shorten operating life—and (2) it is illegal.

This is the point where authors of amplifier articles start weaving tales of "strongest signal on the band" reports received. Not to change fifty years of convention, I'll report that my local contest club, SCORE (the Society of Contest Operators and Radio Experimenters), using the callsign K2XR from Western New York, used the Blockbluster on six meters during our operation in the ARRL June VHF QSO Party (1984) and we *never* had to call anybody twice! We did indeed receive many "strongest signal on the band" reports and did not receive a single report of splattering, distortion, or any similarly discouraging words. We used an IC-551D exciter and a pair of 7-element KLM yagi antennas at sixty feet, thus developing about 54 kilowatts effective radiated power (taking feedline loss into consideration). With this setup, we worked numerous meteor-scatter contacts with a very high level of success. Eureka! My goal, stated in the very first paragraph of this article, was achieved.

I might mention that once you've built the power supply for the Blockbuster, it becomes the foundation on which to build various other high-powered rf decks. My next project probably will be a legal-limit 160-meter monoband amp using another 4-1000A. The supply described in this article is super. Reasonably small and affordable, it delivers all necessary operating voltages for a wide variety of high-powered triodes or tetrodes.

Thanks to KT2B for the excellent photographic work and, as mentioned earlier, to WA2VUN and W2HWG for sheet-metal fabrication.

CU on six! ■

Evert Fruitman W7RXV
2808 West Rancho Drive
Phoenix AZ 85017

Broken Ox Blues

The grid-dip oscillator is a stellar performer, but missing coils can mean big headaches. Avoid frustrations by winding your own.

Although the grid-dip oscillator has been around the laboratory for a long time, Heath introduced it to the general public at a reasonable price in the early 1950s. While the lab models helped scientists find the resonant frequency of tuned circuits, the average amateur still had to "cut and try" as the price kept the instrument out of his reach. Despite some limitations, the ubiquitous Heathkit™ GD-1 and its successors have helped amateurs tune countless transmitters, receivers, and filters.

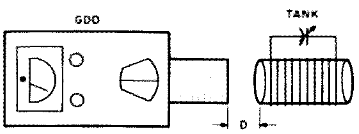


Fig. 1. Typical setup for finding resonant frequency of unknown tank circuit. Meter suddenly "dips" as circuit is tuned to oscillator frequency.

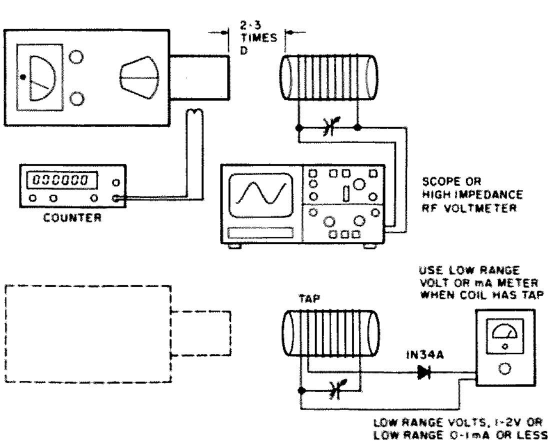


Fig. 2. An improved setup allows more distance between gdo and tank, giving improved accuracy. External indicator is free from the gdo's internal spurious responses.

Regrettably, the coils get broken, the manufacturer can't supply parts for the early models, and the meter then gets shelved or even discarded.

Well, one of those discarded units fell into my outstretched hands and I couldn't wait to fire it up. I took it apart to cement the knob back together and see if the tube was still in place. A quick check with a random-length piece of wire in the coil socket proved that the tube had survived in good condition. A little cleaning up had the gdo ready for action. Then I found out why someone had tossed it out: No one could supply coils or forms. I thought surely someone would know where I could get a set of coils. The best information that I got consisted of instructions on how to use a lathe.

Well, the original coils did have a tendency to work themselves loose at inopportune times, so why not try a "new and improved" coil system? The photos show what happened.

Plastic 35mm film cans and the now common F connectors seemed like a good combination. Many amateurs play with photography or know someone who does. That can give an instant supply of coil forms, forms which "machine" with little effort. The F connectors cost a bit more than the forms, but many times they can be salvaged from old equipment.

The higher-frequency coils up to over 200 MHz need little effort to construct. A piece of brazing rod about three inches long formed into a hairpin loop gives the highest frequency range and is self-supporting. The other two self-supporting coils take the oscillator down to about 20 MHz. The lower-

frequency coils take a bit more effort but are worth it. You can make overlapping ranges down below 200 kHz, although I stopped around 250 kHz as I have another oscillator for that range.

Drill the center of the form for the connector but don't put it in yet. Punch a couple of holes near the top of the form and thread one end of the wire into it. Leave two to three inches of wire inside the form. Wind on the number of turns that the table or your intuition suggests and punch a couple of holes for the other end of the wire. Put a washer and mounting nut on one wire, then poke it through the center mounting hole. Solder it to the center of the F connector. Push the F connector up into the mounting hole and fasten the nut to it.

Make a hole in the bottom of the coil form and run the other wire out to the connector. If you solder directly to the fitting rather than using a solder lug, be sure to scrape the plating off first so that you can make a quick, solid connection with a hot iron. That keeps the plastic coil form from melting.

The low-frequency coils below about 2 MHz need a center tap which has to go to ground. I simply brought out a long flexible lead from the coil and let it float (note Photo C). Scramble-wind these coils in order to get the most inductance with the least distributed capacitance. That will give the widest possible frequency change with the nominal 70-pF tuning capacitor. As the photo shows, even the lowest coil that I wound gives a 50-kHz range.

I found it helpful to write the measured frequency on the coil. Since I had access to an LCR meter, I put the inductance on the coil too. That is useful when using the coils as reference inductors.

I used an old rod antenna for the coil that covers the upper half of the broadcast band. That one puts out a good, hot signal.

As Photos D and E show, the gdo itself needs very little modification. Start by removing the cover and the two screws that hold the coil socket in place. Carefully unsolder the three socket leads. Remove the socket and take it apart. It has two pieces of bakelite sandwiching the connections. Remove the *bottom* layer and the connections. Ream the top section out so that it will hold the F connector. Insert a washer or flattened piece of large-gauge wire under the nut on the bottom of the assembly. Tighten it down. Solder a strap or another piece of flattened wire to

Photo A. By adding an F connector and winding coils on plastic film cans you can recycle older grid-dip meters when you can't get the original coils.

the center conductor. Align the two connections with the areas on the variable capacitor where the original connections were, and solder them in place. Excessive heat may damage the variable cap, so use enough heat to get the job done quickly. Put the two mounting screws back in place.

You may want to put a small bolt through the top cover for grounding the cen-

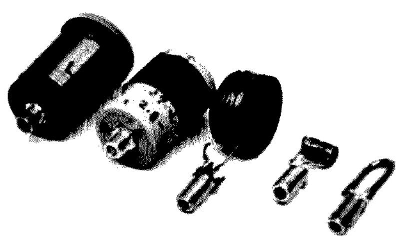


Photo B. Some of the HF and VHF coils (going up to over 200 MHz).

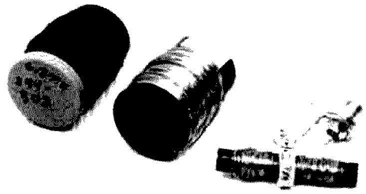


Photo C. Some of the LF coils. The antenna-rod coil gives high output but takes innovative engineering to mount the F connector.

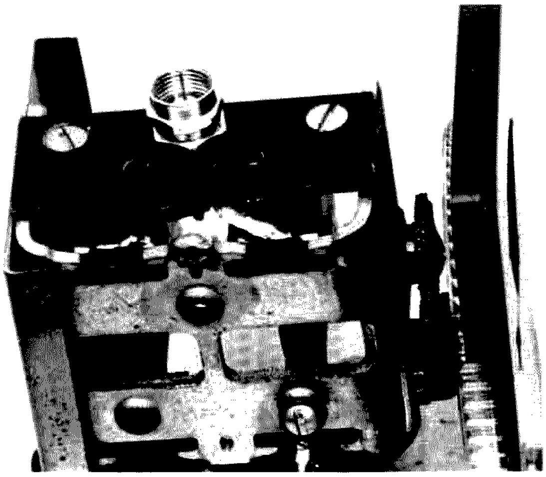


Photo D. Interior view showing connection detail.

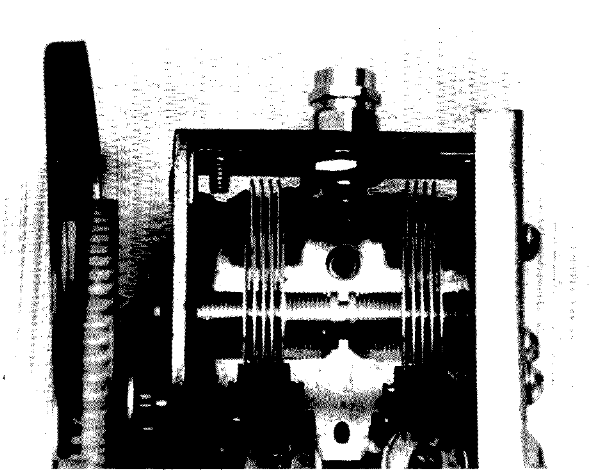


Photo E. Close-up showing assembly detail.

ter tap on the LF coils. While you have the gdo apart and *if* the knob is still in one piece, you may want to put a new scale on the tuning indicator. If you need only a few ranges, they should fit. If you use many overlapping ranges like I did, then a logging scale (say 1-20) would be good. Of course for more than ball-park measurements a counter will pick up some of the signal and give you direct readout. When you finish the calibration, put the cover back on and you are ready to pre-tune networks or measure stray tanks dug out of the spare-parts box.

Although the photos don't show it, you can get an adapter that screws into the socket and gives you the convenience of plug-in coils. The few pFs that it adds show up mostly on the higher frequencies. It does save a lot of time while running down a tuned circuit.

Although the books give the theory of operation, perhaps a quick word here on the practical applications would be in order. In the typical setup shown in Fig. 1, the gdo and the unknown tank are placed near each other. The oscillator frequency is varied until the meter gives a strong indication, usually a dip. Then the tank is moved farther away and the operation is repeated. The dip will be sharper and, therefore, the frequency measurement will be a bit more accurate.

Many times you can get a better tuning indication that is free from the gdo's internal spurious response by using the setup shown in Fig. 2. An *external* instrument tells you when the gdo and the tank are tuned to each other. A high-impedance voltmeter or an oscilloscope work well. The capacitance they add can usually be compensated for once you have the ball-park measurement.

A germanium diode and a low-range voltmeter or mA meter can come close to duplicating actual circuit conditions and give very good results. Again, the tank and the dipper may be separated by a moderate distance and still give easy-to-see, sharp, tuning peaks. A 1N34A or 1N82 works well up to 200 MHz and above. A 0-1-mA meter or your voltmeter's lower range serves as the diode load and the indicator. I would shy away from digital meters because the time they take to sample and give a change in the readout could let you tune past the peak, unless you tune *very* slowly. Additionally, due to their high-input impedance, they would need about a 10,000-Ohm resistor shunted across the input terminals to provide a more or less proper load for the diode.

You can use a 3-5-turn air-wound link near or over the cold end of coils that don't have a built-in tap or link.

Even if you don't have an older instrument waiting for a new set of coils, you can use these techniques with the more modern models for easier, faster tweaking. ■

COIL TABLE

Tuning Range**	Inductance	Wire Size Awg #	Number of Turns	Center Tap	Scramble Wind
244-300 kHz	6.3 mH	32	Lots*	Yes	Yes
344-530 kHz	2.44 mH	32	Lots*	Yes	Yes
508-900 kHz		32	Lots*	Yes	Yes
640-1200 kHz	750 μH	32	Lots*	Yes	Yes
965-1750 kHz	318 μH	32	Lots*	Yes	Yes
1.1-2.6 MHz	322 μH	32	Full form	Yes	Single layer
1.7-5 MHz	115 μH	26	Full form	No	Single layer
2.8-7.7 MHz	39 μH	26	37	No	Single layer
4.4-12 MHz	18 μH	22	26	No	Single layer
10-26 MHz		22	8	No	Single layer
26-70 MHz		22	11	No	Single layer
80-205 MHz		Brazing rod	Hairpin loop		

*As a starting point for the low-frequency coils, wind one with 100 turns with center tap and tack it together. Then measure the frequency and go from there. Twice the number of turns will give about four times the inductance and about one half the frequency.

The 26-70-MHz coil is wound on a ¼" diameter form. It is next to the 200-MHz hairpin loop in Photo B.

**A ¼" wide copper strap about ½" long formed into a loop will get the oscillator up to 250 MHz, but the oscillator may drop out around its low end, 100 MHz.

Inductance measurements are not available on some coils.

BARTER 'N' BUY

Individual (noncommercial) . . . . 25¢ per word
Commercial . . . . 80¢ per word

Prepayment by check or money order is required with your ad. No discounts or commissions are available. Please make your payment to *73*. Rates for multiple insertions are available on request.

Advertising must pertain to amateur radio products or services. No special layouts or positions are possible. All advertising copy must be submitted typewritten (double-spaced) and must include full name and address. Copy limited to 100 words, maximum. Count only words in text. Address, free.

73 cannot verify advertising claims and cannot be held responsible for claims made by the advertiser. Liability will be limited to making any necessary corrections in the next available issue.

Copy must be received in Peterborough by the 5th of the second month preceding the cover date.

Make checks payable to *73* Magazine and send to: Ross Kenyon, Advertising Department, *73* Magazine, 80 Pine Street, Peterborough NH 03458.

MOBILE IGNITION SHIELDING. Free literature. Estes Engineering, 930 Marine Drive, Port Angeles WA 98362. BNB006

NEW HAM-SWL SOCIETY for unity of thought & learning. Open to all. Many topics, awards, free ad space in periodical, society net, museum participation. Shack pics & QSLs welcome. Writers needed. SASE for info to RCSW, 32 Applegate, Bennington VT 05201. BNB197

HAM RADIO REPAIR, tube through solid state. Robert Hall Electronics, PO Box 8363, San Francisco CA 94128; (408)-729-8200. BNB219

QSLS to order. Variety of styles, colors, card stock. W4BPD QSLs, PO Drawer DX, Cordova SC 29039. BNB260

THE DX'ERS MAGAZINE. Up-to-date, informative, interesting. Compiled and edited by Gus Browning W4BPD, DXCC Honor Roll Certificate #4. Send for *free* sample and subscription information today. PO Drawer DX, Cordova SC 29039. BNB261

COCO OWNERS—Free software and hardware brochure. CoCoNuts, POB 9866, San Jose CA 95157-0868. BNB265

CASH PAID for traffic/speed radar equipment. Write or call: Brian R. Esterman, PO Box 8141, Northfield IL 60093; (312)-251-8901. BNB271

KENWOOD 430S owners only! Stop Scan—when the squelch breaks, the scan stops! Adjustable resume scan delay. No modifications! Kit $25, assembled $35. JABCO, R1 Box 386, Alexandria IN 46001. BNB275

COPY SATELLITE PHOTOGRAPHS, weather maps, and press on our military-surplus facsimile recorders. Recorders are solid-state, dual-speed, and fully automatic. Catalog available. Atlantic Sales, 3730 Nautilus Ave., Brooklyn NY 11224; (718)-372-0349. BNB280

$$$$$ SUPER SAVINGS on electronic parts, components, supplies, and computer accessories. Free 40-page catalog for SASE. Get on our mailing list. BCD Electro, PO Box 830119, Richardson TX 75083; (214)-690-1102. BNB289

ATLAS 350XL OWNERS GROUP. Free newsletter. Send QSL with rig s/n and SASE. Know people who repair them? Information to share? Questions? Rod N5NM, Box 2169A, Santa Fe NM 87501. BNB291

FIND OUT what else you can hear on your general-coverage transceiver or receiver. Join a shortwave radio listening club. Complete information on major North American clubs and sample newsletter, $1.00. Association of North American Radio Clubs, 1500 Bunbury Drive, Whittier CA 90601. BNB310

FULL-FEATURED RTTY/ASCII/CW software package for TRS-80 Model III/4. Write for free information package. Clifton J. Turner WB5KCQ, 6319 Boeuf Trace, Alexandria LA 71301. BNB319

CX7 REPAIRS. Mark Mandelkern, 2315 Derby St., Berkeley CA 94705; (415)-549-9210. BNB320

DX ADVENTURE on Montserrat, only $250/week. Details: Chod Harris VP2ML, Box 4881-7, Santa Rosa CA 95402. BNB321

WANTED: old tubes, speakers, amplifiers, by Western Electric, RCA, Cunningham, De Forest, McIntosh, Marantz, Quad, Altec, JBL, Tannoy. Maury, 11122 Atwell, Houston TX 77096; (713)-728-4343. BNB323

IMRA—International Mission Radio Association. Forty countries, 800 members. Assists missionaries with equipment loaned, weekday net. 14.280 MHz, 2:00-3:00 pm Eastern. Brother Bernard Frey, 1 Pryer Manor Road, Larchmont NY 10538. BNB326

FREE: 100 QSLs with first order. Samples 50¢. Gazebo Press, Rt. 4 Box 4148, LaPlata MD 20646. BNB327

ELECTRON TUBES: receiving, transmitting, microwave . . . all types available. Large inventory means next-day shipment in most cases. Daily Electronics, PO Box 5029, Compton CA 90224; (213)-774-1255. BNB330

WANTED: radios, tubes pre-1939 for my collection. Howard Stone, HCR-3, Box 418, Deer River MN 56636. BNB332

80-METER MOBILE, Fisher TS-25 with six-volt alternator. Offers. KB4EYY, 216 London Drive, Kissimmee FL 32741. BNB333

CODE-PRACTICE PROGRAMS diskette for IBM PC, PC/jr. $10.00 ppd. Andrew Modla/73/N3EGH, 5 Derby Place, Newtown PA 18940. BNB334

HAM TRADER YELLOW SHEETS, in our 24th year. Buy, swap, sell ham-radio gear. Published twice a month. Ads quickly circulate—no long wait for results. SASE for sample copy. $10.00 for one year (24 issues). PO Box 356, Wheaton IL 60189. BNB335

QSL CARDS—50 for $5.00 and 100 for $8.00, postpaid. Kenneth Hand WB2EUF, PO Box 708, East Hampton NY 11937. BNB336

COMMODORE Authorized Service Center, 24-hr. service. WA2AJQ, 303 S. Vermont Ave., Royal Oak MI 48067; (313)-399-3990. BNB337

START COPYING CW THE EASY WAY! Learn to copy code like the pros! Gain on-the-air confidence quickly! Easy-to-learn word-recognition system for the ham who already knows the code. 14-day money-back guarantee. Order the QSO-Trainer™ Code Course. Send $14.95 + $2.00 shipping and handling (IN residents add $0.85) to AVC Innovations, Inc., Dept. 7C, PO Box 20491, Indianapolis IN 46220. BNB338

REPLACE RUSTED ANTENNA BOLTS with stainless steel. Small quantities, free catalog. Elwick, Dept. 548, 230 Woods Lane, Somerdale NJ 08083. BNB339

C64, VIC-20, TI-99/4A, TS-1000, TS-2068 software. Free Catalog. Turn your programs into Profit$. WD0GIY, Steve's Software Source, 9922 Harwich, Crestwood MO 63126-2318. BNB340

DIGITAL AUTOMATIC DISPLAYS for FT-101s, TS-520s, Collins, Swan, and all others. Six ½" digits in a 5" wide by 1¼" high and 9" deep metal cabinet. Send $1.00 for information. Grand Systems, Dept. A, PO Box 3377, Blaine WA 98230. Canadians VE7LB. BNB341

COMPUTERIZE YOUR IC-720. Keyboard frequency entry, 64 memories, scanning (frequency, memory, and mode), and many more features! Requires no interface, just cable—directions included. For Commodore 64. Cassette $14.75, disk $16.75, ppd. Cables also available. David Oliver W9ODK, Rt. 2, Box 75A, Shevlin MN 56676. BNB342

RETAIL STORE being liquidated by mail auction. Parts, tools, test equipment, ham supplies. SASE to ESI, Box 328, Mesa AZ 85201. BNB343

PRACTICAL APPLICATIONS MATHEMATICS SYSTEM on disk for C-64. Will calculate geometric shapes, linear regression, linear interpolation, and base change. A must for calculating mechanical aspects of tower and antenna construction. $29.95. Micro*Energy* Systems, PO Box 5291, High Point NC 27262; (919)-885-0433. BNB344

SALE! ICOM 730 HF XCVR, very mint. KA3ARS, (215)-678-3647. BNB345

SPECIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices, 73 Magazine, Pine St., Peterborough NH 03458.

HELEN KELLER ARTS FESTIVAL
JUN 29

The Muscle Shoals Amateur Radio Club (W4JNB) will be active from 1600 UTC to 2300 UTC, June 29, 1985, from the Helen Keller Arts Festival in Tuscumbia AL. For a special-event certificate, send a large SASE to PO Box 2745, Muscle Shoals AL 35662-2745. There will be phone and CW operation on the 80-, 40-, and 20-meter General bands. For further information, contact Dyer N. Ruggles KA4JWD, 116 Hiwassee, Sheffield AL 35660.

BRESSLER PA
JUL 4

The Harrisburg RAC will sponsor its annual Firecracker Hamfest on July 4, 1985, at the Bressler Fire Company picnic grounds, near Exit 1 of I-283 at Route 441; follow the signs to Bressler. Three motels and several restaurants are located at this exit. Admission is $3.00, with XYLs and kids free. There is no charge for tailgating. VE exams will be given. There is parking for 1000 cars. For more information or for table reservations, contact Dave KC3MG, 131 Livingston Street, Swatara PA 17113; (717)-939-4957.

FORT LARAMIE WY
JUL 4-5

The High Plains ARC will operate K7YPT from 0000 UTC on July 4, 1985, through 0000 UTC on July 5, 1985, at historic Fort Laramie. Frequencies will be: phone—3.850, 7.250, 14.300, 21.360, and 28.550; CW—50 kHz up from the lower band edge. For a QSL, send a business-size SASE to K7YPT, PO Box T, Torrington WY 82240.

USS NAUTILUS
JUL 4-6

The *Nautilus* comes home! The world's first nuclear submarine, the *USS Nautilus* (SSN-571), is returning to the Submarine Base in New London CT, where it will be put on permanent public display while remaining commissioned. The Submarine Base station, K1SSN, will be operated as a special-event station on July 4, 5, and 6, 1985, to honor the *Nautilus'* return on July 5. Members from the K1SSN Club Station, Tri-City ARC, RASON, and SCRAMS will operate K1SSN from 1400 UTC to 0100 UTC on each of the three days. Look for K1SSN in the lower 20 kHz of the 80-10-meter General-class bands, phone and CW, and the center of the Novice bands. QSL via Tri-City ARC, PO Box 686, Groton CT 06340. For further information, please contact Bob Dargel KA1BB, 8 Willow Lane, East Lyme CT 06333; (203)-739-8016 or (203)-446-7325 (business).

RAPID CITY SD
JUL 5-7

The Black Hills ARC will celebrate its 50th anniversary by sponsoring the 1985 ARRL Dakota Division Convention on July 5-7, 1985, at Howard Johnson's, Exit 59 off I-90, Rapid City SD. Features include exhibits, a flea market (free tables), forums, and alternate activities for the whole family. Pre-registration and a Saturday-night banquet ticket is $18.00. Pre-registration is $6.50 (pre-registration deadline is June 10). Registration after June 10 is $7.50. Additional banquet tickets are $12.50. Sunday buffet tickets are $6.75 ($3.75 for children 12 and under). Talk-in on .16/.76 and .34/.94. For further information, tune in the SD Evening Net (3870) or call (605)-787-5243 or (605)-343-6791. For pre-registration (make checks payable to Black Hills ARC), write to Gene F. Bauer KXØU, 713 Blaine Avenue, Rapid City SD 57701. Indicate if you desire information on motels or campgrounds.

ATLANTA GA
JUL 6-7

The Atlanta Radio Club, Inc., will sponsor the Atlanta Hamfestival/ARRL Convention in the Georgia State World Congress Center on July 6 and 7, 1985. Everything will be indoors this year, with much improved facilities and access. For further information, contact Bill Schmidt KF4CQ, Secretary and Hamfestival Chairman, 219 Devonwood Drive, Atlanta GA 30328.

TOM SAWYER DAYS
JUL 6-7

The Hannibal Amateur Radio Club, Inc., will operate a special-event station from the National Tom Sawyer Days celebration, on Saturday and Sunday, July 6 and 7, 1985, from 1500-2100 UTC both days. Frequencies will be: 7.245, 14.290, 21.400, and 28.770 phone and 7.125 and 21.125 CW. To receive a certificate, send a large (8 × 10) SASE and your personal QSL card confirming the contact to Hannibal Amateur Radio Club, Inc., WØKEM, 2108 Orchard Avenue, Hannibal MO 63401. For further information, please contact Bob Blackler, 210 N. 6th, Hannibal MO 63401; (314)-221-3723.

KINGSTON PA
JUL 7

The Murgas ARC (K3YTL) will sponsor the annual Wilkes-Barre Hamfest on Sunday, July 7, 1985, rain or shine, beginning at 8:00 am, at the 109th F. A. Armory, Market Street, Kingston PA (across the river from Wilkes-Barre). Admission is $3.00 and women and children under 16 are free. Tailgating spaces are $2.00 each. Tables and commercial power will be available. Setup begins at 6:00 am. Talk-in on 146.01/.61 and .52 simplex. For further information, contact the Hamfest Committee, PO Box 1094, Wilkes-Barre PA 18703; (717)-388-6863.

NATIONAL CHERRY FESTIVAL
JUL 7-13

The Cherryland ARC will operate special-event station KA8QVH to commemorate the National Cherry Festival in Traverse City MI. Daily operation is scheduled from 0100 UTC July 7, 1985, through 0200 UTC July 13, 1985, and will be in the center portion of the 10- through 80-meter General phone and CW bands, and the Novice bands. Send a large SASE with your QSL addressed to Ed Irwin KA8QVH, 346 Peninsula Trail, Traverse City MI 49684, for an attractive National Cherry Festival certificate.

DOUGLAS WY
JUL 12-14

The Great Plains Repeater Association and the High Plains Amateur Radio Club will jointly sponsor the 1985 Wyoming Hamfest, to be held at the Wyoming State Fairgrounds in Douglas, Wyoming, on July 12-14, 1985. Items of interest include distributor displays, indoor flea market (tables available), license exams, seminars, auction, banquet, breakfast, and much more! There will be ample RV parking with or without full hookups (plenty of motels). For full information or advanced registration, please send an SASE to Doug Des-Enfants WA7WXQ, North Star Route, Torrington WY 82240.

DUTCHESS COUNTY NY
JUL 13

The Mount Beacon Hamfest will be held on July 13, 1985, from 8:00 am to 3:00 pm, at the Arlington Senior High School, Poughkeepsie/Lagrange, Dutchess County NY. Admission is $2.00 and XYLs and kids are free. Tailgating spaces are $3.00 and tables are $4.00 (both include one free admission). The auction will take place at 2:00 pm. Free parking and food will be available. Talk-in on 146.37/.97 and 146.52. For more information, contact Julius Jones W2IHY, RR2, Vanessa Lane, Staatsburg NY 12580; (914)-889-4933, or Steve Quigley KD2AK, Straub Drive, Pleasant Valley NY 12589; (914)-635-8539.

OAK CREEK WI
JUL 13

The South Milwaukee ARC will hold its annual swapfest on Saturday, July 13, 1985, from 7:00 am to 4:00 pm, at American Legion Post #434, 9327 South Shephard Avenue, Oak Creek WI. Admission is $3.00, which includes a "happy time" with free beverages. Parking, a picnic area, hot and cold sandwiches, and free overnight camping will be available. Talk-in on 146.94. For a map and more information, write to the South Milwaukee ARC, PO Box 102, South Milwaukee WI 53172-0102.

EAU CLAIRE WI
JUL 13

The Eau Claire Amateur Radio Club will hold its annual hamfest on Saturday, July 13, 1985, from 8:00 am to 4:00 pm, at the 4-H building in Eau Claire WI. Tickets are $2.00 in advance and $3.00 at door. Free tables and coffee will be available. Talk-in on .31/.91 and .52 simplex. For information or tickets, send an SASE to Gene Lieberg KA9DWH, 2840 Saturn Ave., Eau Claire WI 54703.

SHEBOYGAN WI
JUL 13

The Sheboygan County ARC will sponsor the sixth annual Lakeshore Swapfest and Brat Fry on July 13, 1985, from 10:00 am to 4:00 pm, at the Wilson Town Hall, south of Sheboygan WI. Admission is $2.50 in advance and $3.00 at the door. Children under 12 (with family) are free. Tables are free. Camping is available at Terry Andre State Park. Food will be served. Talk-in on .66/.06 and .52. For more information, contact KR9S, 6400 Hawthorn Road, Sheboygan WI 53081; (414)-457-3366 after 5:00 pm CDT.

MAPLE RIDGE BC
JUL 13-14

The Maple Ridge Amateur Radio Club will sponsor the Maple Ridge Hamfest on July 13 and 14, 1985, at St. Patrick's Center, 22589 121st Ave., Maple Ridge, BC. Admission for hams is $5.00, for non-hams $2.00. Food, swap and shop, commercial

displays, bunny hunt, ladies' and children's programs will be available (close to shopping and swimming). Camper space (no hookups) will be available. Talk-in on 3.758 MHz, 146.20/.80, and 146.34/.94. For more information or pre-registration (20% off gate admission), contact Maple Ridge ARC, Box 292, Maple Ridge, BC, Canada V2X 7G2.

CHARLESTON SC
JUL 13-14

The Charleston Amateur Radio Society will sponsor the Charleston Hamfest on July 13 and 14, 1985, at the Omar Shrine Temple on East Bay Street, Charleston SC, from 8:30 am to 4:00 pm on Saturday, and 9:00 am to 4:00 pm on Sunday. General admission is $5.00, with children 12 and under going free, which includes the admission to the Hospitality Room (7:30 pm to 11:00 pm Saturday). FCC exams will be given Saturday. There will be a buffet available on both days. Flea-market tables cost $5.00; commercial booths cost $40.00. Talk-in on 146.19/.79. For further information, contact Hamfest Committee, PO Box 70341, Charleston SC 29405; (803)-747-2324 or (803)-554-8058.

SUMMER EXTRAVAGANZA
JUL 13-14

The Parks and Recreation Department of the City of Waynesboro VA and the Valley Amateur Radio Association will operate special-event station KI4BR in Ridgeview Park, in celebration of Summer Extravaganza. Hours will be from 1700 UTC on Saturday and Sunday, July 13 and 14, 1985. A First Edition Certificate will acknowledge QSO and receipt of QSL. Send an SASE to KI4BR, PO Box 565, Waynesboro VA 22980 for further information.

MARION COUNTY IN
JUL 13-14

The Indianapolis Hamfest will be held on July 13 and 14, 1985, at the Marion County Fairgrounds, at the intersection of Interstates 74 and 465, Marion County IN. The $5.00 admission charge entitles you to free parking. Flea-market setup on Saturday is at 8:00 am. Commercial vendor setup on Saturday is at 10:00 am. The hamfest runs to 5:00 pm on Saturday. On Sunday, gates open at 6:00 am and the commercial building opens at 8:00 am. There will be free camper facilities and hookups available on the grounds. There are motels close by. There will be technical forums, the ARRL State Convention, and a banquet. For more information, contact the Indianapolis Hamfest, PO Box 11776, Indianapolis IN 46201.

BATTLE CREEK MI
JUL 13-21

The Southern Michigan Amateur Radio Society will operate W8DF/8 during the Seventh World Hot-Air Balloon Championship, July 13-21, 1985, in Battle Creek, Michigan, at W. K. Kellogg Regional Airport. Operation will be on phone in the center portions of General-class 80-10-meter bands, and CW in the Novice bands. For a special QSL, send an SASE to PO Box 934, Battle Creek MI 49016.

DOWNERS GROVE IL
JUL 14

The DuPage Amateur Radio Club will sponsor a hamfest/computerfest on Sunday, July 14, 1985, at American Legion Post 80, Downers Grove IL. Admission is $3.00. There will be a large outdoor flea market and swappers row. Indoor commercial space will be available. Refreshments and free parking will be available. Talk-in on 146.52 simplex. For more information, send an SASE to W9DUP, PO Box 71, Clarendon Hills IL 60514, or call (312)-971-3294 between 8:00 am and 9:00 pm.

LAPORTE IN
JUL 14

The LaPorte and Michigan City ARCs will sponsor their summer hamfest on Sunday, July 14, 1985, from 8:00 am to 2:00 pm, at the LaPorte County Fairgrounds, on State Road 2, west of Laporte IN. Admission is $3.00. Indoor tables are available by reservation for $.40/ft. Food and parking will be available. For table reservations or for more information, write to PO Box 30, LaPorte IN 46350.

LOUISVILLE OH
JUL 14

The Tusco ARC (W8ZX) and the Canton ARC (W8AL) will sponsor the 11th annual Hall of Fame Hamfest on July 14, 1985, at the Nimishillen Grange, 6461, Easton Street, Louisville OH (just east of Canton on US Route 62). Registration is $2.50 in advance and $3.00 at the gate. Tables are for rent on reserved basis only. Parking is $2.00 per vehicle. The deadline for table reservations is July 1st. Features include good food, a large flea market, dealers, forums, and more. Talk-in on 146.52/.52 and 147.71/.12 (W8ZX). For more information or reservations, contact Butch Lebold WA8SHP, 10877 Hazelview Ave., Alliance OH 44601; (216)-821-8794.

LANCASTER OH
JUL 14

The Lancaster and Fairfield County Amateur Radio Club will hold its annual hamfest on Sunday, July 14, 1985, from 8:00 am to 4:00 pm, at the Fairfield County Fairgrounds, Lancaster OH. Admission is $3.00 in advance and $4.00 at the door. Tables are $4.00 in advance and $5.00 at the door. Space for your table is $3.00 in advance and $4.00 at the door. Refreshments and parking will be available. Talk-in on 147.03/.63 and 146.52 simplex. For more information, write to the Lancaster ARC, PO Box 3, Lancaster OH 43130.

BOWLING GREEN OH
JUL 14

The 21st annual Wood County Ham-A-Rama will be held on Sunday, July 14, 1985, beginning at 8:00 am, at the Wood County Fairgrounds, Bowling Green OH. Admission and parking are free. Advance table rentals are $5.00 to dealers only. The trunk sale will be on a paved lot. Food will be available. Setup is available on Saturday (July 13) until 8:00 pm. Talk-in on 147.18 and .52. For more information or dealer rentals, send an SASE to the Wood County ARC, c/o Craig Henderson N8DJB, 7368 Scotch Ridge Road, Pemberville OH 43450.

BALLOON RACES
JUL 19-20

The Indian Hills Community College Amateur Radio Club will sponsor a special-event station during the 1985 Ottumwa Hot-Air Balloon Races on Friday, July 19, 1985, and Saturday, July 20, 1985. The club will operate under club callsign WAØIUQ on SSB only on the following frequencies: 3960, 7260, and 14260 kHz (QRM permitting). Operation will commence at 2200 UTC and end at 0400 UTC each day. A commemorative QSL card will be issued to all amateurs who contact WAØIUQ and provide a SASE with their QSL card. QSL to WAØIUQ *Callbook* address.

PETOSKEY MI
JUL 20

The Straits Area ARC will hold its twelfth annual Swap 'n' Shop on July 20, 1985, from 9:00 am to 2:00 pm, at the Emmet County Fairgrounds, Petoskey MI. Admission is $2.50 and tables are $3.00. Refreshments will be available. There will be free parking Friday night for self-contained RVs. Petoskey State Park is also nearby. Talk-in on .07/.67 and .52. For more information, send an SASE to Joe Werden WD8MJB, Chairperson, PO Box 444, Conway MI, or call (616)-347-8693.

SUSSEX COUNTY NJ
JUL 20

The Sussex County ARC will sponsor SPARC 85 on July 20, 1985, beginning at 8:00 am, at the Sussex County Fairgrounds, Plains Road, off of Route 206. Admission is $2.00. Indoor tables are $7.00 each and tailgate spaces are $5.00. Free parking and refreshments will be available. Talk-in on 147.90/.30 and 146.52. For further information, contact Donald R. Stickle K2OX, Weldon Road, RD #4, Lake Hopatcong NJ 07849; (201)-663-0677.

WELLINGTON OH
JUL 20

The Northern Ohio Amateur Radio Society will sponsor a NOARSfest on July 20, 1985, at the Lorain County Fairgrounds, Wellington, Ohio. Tickets are $2.50 in advance and $3.00 at the door. There will be ample indoor commercial space, although reservations are required. There will be a huge outdoor flea-market area. There is a $3.00 charge per car space. Overnight parking is available for RVs and campers (no hookups). Talk-in on 146.10/.70. For FCC exam information, contact Dave AI8M, 331 Courtland, Elyria OH 44035; (216)-324-4574. For reservations, information, or tickets, write to NOARSfest, PO Box 354, Lorain OH 44052; (216)-282-4256.

TOPSFIELD MA
JUL 20-21

The first annual Heavy Hitters Hamfest will be held on Saturday and Sunday, July 20-21, 1985, from 9:00 am to 4:00 pm (both days), at the Topsfield Fairgrounds, US Route 1 (8 miles north of Route 128), Topsfield MA. Admission is $3.00 in advance and $4.00 at the door. Non-ham spouses and children will be admitted free. There will be a giant flea market (with ample indoor space in case of rain). Flea-market setup begins at 6:00 am on Saturday. Features include commercial exhibitors, forums on the ARRL, packet radio, AMSAT, ATV, and ARES/RACES, CW and OSL contests, a hidden transmitter hunt, ATV and packet demonstrations, a traffic-handlers' rap session, a musical coffeehouse (BYO instruments), and refreshments. Alternate activities include sports, a local guided hike, Trivial Pursuit, and a first-aid lesson. There will be free Saturday-night camping for tents and self-contained RVs. Talk-in on 146.64 and 147.285. License exams (no Novice exams) will be held at a nearby school. Send Form 610 and a check for $4.00 payable to ARRL/VEC by June 21 to Topsfield Exams, c/o PO Box 71, Hanover MA 02339. For advance tickets, send an SASE to Heavy Hitters Hamfest, PO Box 411, Waltham MA 02254. For further information, contact Russ Corkum WA1TTV, 21 Thorndike Street, Arlington MA 02174.

DES MOINES IA
JUL 20-21

The Des Moines Radio Amateur Association will hold an Electronic Fair in Des Moines IA on July 20 and 21, 1985, at the Airport Hilton Inn, to showcase the latest in satellite television, computers, amateur radio, and electronics. The fair combines the Iowa American Radio Relay League Convention with the Des Moines Hamfest. Technical seminars will be held both days featuring excellent programs for computer and satellite enthusiasts, amateur-radio operators, and spouses. Admission fee is $2.00; $3.00 for flea-market parking. There will be a banquet the evening of July 20, 1985, at a cost of $15.00 per person. Additional details are available from the Des Moines Radio Amateur Association, PO Box 88, Des Moines IA 50301.

WHEELING WV
JUL 21

The Triple States Radio Amateur Club will hold its 7th annual Wheeling WV Hamfest and Computer Fair on Sunday, July 21, 1965, from 9:00 am to 4:00 pm, at Wheeling Park, Wheeling WV. Admission is $3.00. Children under 12 are free. Dealers are welcome. Everything is under one roof, and tables will be available. There will be 5 acres of flea market, free parking, and refreshments. Talk-in on 146.31/.91 or 147.75/.15. For further information or a map, contact Jay Paulovicks KD8GL, RD 3 Box 238, Wheeling WV 26003; (304)-232-6796, or TSRAC, Box 240, RD 1, Adena OH 43901; (614)-546-3930.

OSHKOSH WI
JUL 26-AUG 2

The Oshkosh Amateur Radio Club, in conjunction with the SOLAR Association (a repeater co-op), will host EAA hams for the 1985 convention from July 26, 1985, through August 2, 1985, at Wittman Field, in Oshkosh. The EAA Ham Shack Hospitality Site, located at the north end of the commercial exhibit area, will be available for you to rest your feet, charge your batteries, or leave messages. Look for the red and white ARRL flag. On Saturday, July 27, 1985, at 3:00 pm, there will be a gathering for all EAA hams hosted by the Oshkosh Amateur Radio Club. Bratwurst, burgers, and refreshments will be available free of charge. Bring the whole family. If you have never had a *real Wisconsin* bratwurst, you are in for a real treat! Information throughout the convention will be available via the 147.945 repeater, or by stopping at the EAA Ham Shack Hospitality Site in person. Ground communications will also be run on 146.400 simplex. Both frequencies will be monitored for the entire week. For further information, contact Forest Schafer WD9IWL, 417 Willow Street, Omro WI 54963.

MANISTIQUE MI
JUL 27-28

The 1985 Upper Peninsula Hamfest will be held on July 27-28, 1985, from 6:00 am to 5:00 pm on Saturday, and from 8:00 am to 2:00 pm on Sunday, at St. Francis de Sales School, Manistique MI. There will be a fish fry, early setup, and eyeball QSO for those who arrive on Friday evening. A banquet will be held on Saturday at 6:30 pm. Registration is $3.50. Table space is $3.00 per 4-foot table. Free babysitting will be available. For more information, contact Debbie Barton WD8IBT, 509 Range Street, Manistique MI 49854; (906)-341-5694 after 3:00 pm.

OLIVER BC
JUL 27-28

The Okanagan Valley of British Columbia will sponsor the Okanagan International Hamfest on July 27th and 28th, 1965, beginning at 9:00 am on Saturday, July 27th, at the Oliver Centennial Park, Oliver, British Columbia. Bring your hobbies/crafts for display or sale. Please note that the potluck supper on Saturday has been changed to 6:00 pm. Talk-in on 146.34/.94 and .76/.76. For further information, contact Lota Harvey VE7DKL, 584 Heather Road, Penticton, BC, Canada V2A 1W8; (604)-492-5768.

SPACE DAY
JUL 27-28

The Cascades Amateur Radio Society will sponsor their third annual Space Day from the Michigan Space Center. Special-event stations will be on the air from 0000 UTC July 27, 1985, through 1900 UTC July 28, 1985, 10 kHz into the General portions of all bands. For a certificate, send OSL and $1.00 for postage and materials to CARS, PO Box 512, Jackson MI 49204.

MOSCOW BLOWOUT
JUL 27-28

The Wichita Amateur Radio Club is sponsoring a Moscow Blowout at Moscow KS on July 27 and 28, 1985. The callsign will be W0SOE. The frequencies will be 5 to 10 kHz from the bottom edge of the General phone bands. OSL will be via W0SOE. There will be a mini-DXpedition to give everyone a chance to work Moscow.

ASHEVILLE NC
JUL 27-28

The Western Carolina Amateur Radio Society will hold its annual hamfest on Saturday, July 27, 1985, and Sunday, July 28, 1985, at the Buncombe County Firemen's Training Center in Asheville NC. Admission is $4.00 at the gate and $3.50 in advance. There will be camping (no hookups), forums, bingo, free parking, and VEC exams. For outside flea-market sites, bring your own table. Talk-in on .16/.76 and .31/.91. For advance tickets, contact Marvin Soloman KI4EA, 14 Carjen Avenue, Asheville NC 28804. All other inquiries should go to Earl Elliott KI4UO, 17 Emory Road, Asheville NC 28806.

WEST FRIENDSHIP MD
JUL 28

The Baltimore Radio Amateur Television Society (BRATS) will sponsor the Maryland Hamfest and Computerfest on Sunday, July 28, 1985, at the Howard County Fairgrounds, Route 144 at Route 32, adjacent to I-70, West Friendship MD. The facilities are accessible to the handicapped. Admission is $4.00. Tables along a wall with access to ac power are $20.00 each, or 4 for $75.00. Tables in the center of the floor are $10.00 each, with special rates for booths of 12 or 16 tables. Tailgating is $3.00 per space. Dealer setup will begin at 2:00 pm on Saturday, July 27 (overnight security will be provided). Free VE examinations will be given and no advanced registration is required. Refreshments will be available. Talk-in on 146.16/.76, 147.63/.03, and 146.52. For further information or for table reservations, contact Mayer Zimmerman W3GXK, BRATS, PO Box 5915, Baltimore MD 21208.

DENVER CO
JUL 30-AUG 1

The Amateur Radio Motorcycle Club Rocky Mountain Roundup III will be held July 30 through August 1, 1985, somewhere west of Denver CO. The exact location will be named later. Riding radio operators check the ARMC Net on Thursday nights, 0300 UTC, 7237.5 kHz. Send a business-size SASE to Gary McDuffie AG0N, Rt. 1, Box 464, Bayard NE 69334, and ask for net information.

JACKSONVILLE FL
AUG 3-4

The twelfth annual Greater Jacksonville Hamfest will be held on August 3-4, 1985, from 8:00 am to 5:00 pm on Saturday, and from 9:00 am to 3:00 pm on Sunday, at the Jacksonville Civic Auditorium, on the waterfront in downtown Jacksonville. Admission is $4.00 and children under 16 will be admitted free. Swap tables are $9.00 for one day and $15.00 for both days. Forums, meetings, technical presentations, and an exhibitors' area and indoor swap area will be featured. The facilities are completely air conditioned. For more information, ta-

ble reservations, or hotel information, send an SASE to the Jacksonville Hamfest Association, PO Box 23134, Jacksonville FL 32241.

TALK SO THEY MAY WALK
AUG 3-4

The Kansas City MO Ararat Shrine Radio Club (WAØNQA) will host its second annual talk-in on August 3-4, 1985, for the benefit of the Crippled Children's Hospitals. We will look for you on the air from 10:00 am to 10:00 pm CST. We will be on the lower 10 kHz of 80, 20, 40, and 15 meters, as well as the 40-meter Novice band. We will offer a two-color certificate with your call and name. Send a large SASE and $1.00 to QSL Manager, Mr. J. V. Foust KAØGBK, 5240 N. Palmer, Kansas City MO 64119.

GLENN MI
AUG 4

The Black River Amateur Radio Club will sponsor its annual VHF Picnic and Swap and Shop on Sunday, August 4, 1985, from 10:00 am to 3:00 pm, at the West Side Allegan County Park near Glenn MI (10 miles north of South Haven via I-196, Exit 30). Admission will be $2.00. There will be free table and trunk sales. There will be picnic tables, a playground, a Lake Michigan beach, and ample parking. There is no food vendor in the park. For more information, contact Ed Alderman KI8Z, 56500 48th Ave., Lawrence MI 49064; (616)-674-3567.

WORLD POLICE/FIRE GAMES
AUG 4-7

The San Jose State University ARC will operate W6YL to commemorate the 1985 World Police/Fire Games. Operation will be from: 1900 UTC August 4 to 0700 UTC August 5; 1900 UTC August 5 to 0700 UTC August 6; 1900 UTC August 6, to 0700 UTC August 7. There will also be some operation August 7 through 11. Frequencies will be 3.870, 7.240, 14.270, and 147.555 for phone; 7.125 and 14.040 for CW. For a special certificate, send a large SASE to SJSU ARC, c/o Student Programs and Services, Box 2, San Jose State University, San Jose CA 95192.

GEORGETOWN KY
AUG 11

The Bluegrass Amateur Radio Society will sponsor the Central Kentucky ARRL Hamfest on Sunday, August 11, 1985, from 8:00 am to 5:00 pm, at the Scott County High School, Longlick Road and US Route 25, Georgetown KY. Tickets are $3.50 in advance and $4.00 at the gate. There is no charge for outside flea-market space. Features will include technical forums, license exams, awards, and exhibits—all in air-conditioned facilities. Talk-in on .76/.16. For more information or tickets, send an SASE to Scott Hackney KI4LE, 629 Craig Lane, Georgetown KY 40324.

WILLOW SPRINGS IL
AUG 11

The Hamfesters Radio Club, Inc., will sponsor their 51st annual hamfest on Sunday, August 11, 1985, at Santa Fe Park, 91st and Wolf Road, Willow Springs IL, southwest of Chicago. There will be an exhibitor pavilion and the famous swappers row. Tickets at the gate will cost $4.00; in advance $3.00. Talk-in on 146.52. For tickets, mail check or money order to Hamfesters, PO Box 42792, Chicago IL 60642.

ST. CLOUD MN
AUG 11

The St. Cloud Amateur Radio Club will hold a hamfest on August 11, 1985, at the Sauk Rapids Municipal Park, on the north edge of Sauk Rapids off MN Highway 15 (Benton Drive). Displays, demonstrations, and trades will be featured. Tickets will cost $3.00. There will be a snack counter. Talk-in on .34/.94 primary, .615/.015 secondary. For further information contact SCARC, Box 141, St. Cloud MN 56302.

DALTON MA
AUG 11

The Northern Berkshire Amateur Radio Club will sponsor a hamfest on Sunday, August 11, 1985, beginning at dawn, at the Dalton American Legion, Route 9, Dalton MA. Admission is $1.00, with XYLs, YLs, and children admitted free. A few tables will be available at no charge on a first-come, first-served basis. Food will be available. Free overnight camping will be permitted on Saturday night (August 10) beginning at 6:00 pm. Talk-in on 146.91.

GREEN BAY WI
AUG 17

The Green Bay Mike and Key Club's Summer Swapfest will be held on Saturday, August 17, 1985, at the Ashwaubenon Community Center, Anderson Drive, located across from Baypark Square Mall (take the Oneida Street Exit off either Hwy. 172 or US Hwy. 41). There will be free admission and parking. Doors open at 8:00 am. 8-foot tables are available by reservation at a charge of $5.00, with a 4-table limit. For further information, contact Bill Johnson N9CNO, 2177 Orrie Lane, Green Bay WI 54304; (414)-494-8948.

WASHINGTON DC
AUG 22-24

The Personal Computer and Standard Computer Interfacing for Scientific Instrument Automation Workshop, sponsored by Virginia Tech, will be held August 22-24, 1985, in Washington DC. The cost is $450 for the three-day session. This is a hands-on workshop, with each participant wiring and testing interfaces. The course will be directed by Mr. David E. Larsen and Dr. Paul E. Field. For more information, contact Dr. Linda Leffel, C.E.C., Virginia Tech, Blacksburg VA 24061; (703)-961-4848.

ITHACA NY
AUG 24

The Tompkins County Amateur Radio Club will sponsor the Finger Lakes Hamfest on August 24, 1985, 12 miles north of Ithaca NY on Route 96. There will be a flea market, dealers, programs, and free overnight camping. Talk-in on .37/.97. For more information, contact David Flinn W2CFP, 866 Ridge Road, Lansing NY 14882; (607)-533-4297.

MARYSVILLE OH
AUG 25

The Union County ARC will sponsor its 9th annual hamfest on August 25, 1985, from 6:00 am to 4:00 pm, rain or shine, at the fairgrounds in Marysville OH. Admission is $3.00 at the gate, $2.00 in advance. Children and XYLs are admitted free. Flea-market space is $1.00 per 10-foot space. There will be overnight camping permitted on Saturday night. Food will be available. For further information, contact Gene Kirby W8BJN, 13613 US 36, Marysville OH 43040; (513)-644-0468.

WILLOW SPRINGS IL
SEP 8

The Bolingbrook Amateur Radio Society will hold BARS Hamfest 85 on Sunday, September 8, 1985, at Santa Fe Park, 91st Street and Wolf Road, Willow Springs IL. Admission is $2.00 in advance and $3.00 at the gate. Overnight parking will be available. Food will be available. Talk-in on 147.33/.93 and 146.52. For more information, contact Ed Weinstein WD9AYR, 7511 Walnut Avenue, Woodridge IL 60517; (312)-985-0527.

GREAT SALT PLAINS LAKE
SEP 8

The third annual Great Salt Plains Ham Social (serving the Oklahoma-Kansas state line area) will be held on September 8, 1985, at the community building on the south side of Great Salt Plains Lake. Free swap tables and refreshments will be available. Talk-in on 147.90/.30. For more information, contact Steven Walz WA5UTO, PO Box 222, Cherokee OK 73728; (405)-596-3487.

WIA 75TH ANNIVERSARY

The Wireless Institute of Australia, the world's first radio society, will celebrate its 75th anniversary during 1985. The WIA 75 Award will be available during the period from March 1, 1985, to December 31, 1985. To qualify, amateurs (and SWLs) need to contact (log) 75 members of the WIA. A contact will be valid only if the WIA member's individual membership number is logged. No more than 30 WIA members may be logged in any one callsign area. Send a log extract of the 75 members contacted and $2.00 (Australian) to WIA 75 Award Manager, Wireless Institute of Australia, 412 Brunswick Street, Fitzroy 3065, Victoria, Australia.

HAM HELP

I am in need of a schematic and information about the type of needle needed for an old General TV and Radio model 337 phonograph.

Bill Fletcher AF9B
3302 Leopold Way #111
Madison WI 53713

I am in need of the manual and/or schematic for the Mullard C11 transmitter and matching receiver (British Military), as well as the manual for the Hallicrafters Sky Champion shortwave receiver. I will gladly pay for any costs involved.

Carl Nielsen VE7EAO
120 Gull Cr.
Prince Rupert BC
V8J 4G5 Canada

I would like to correspond with anyone who has used a Tano Corp. Dragon computer for any purpose.

M. McDaniel W6FGE
940 Temple St.
San Diego CA 92106

I am looking for information or help from anyone who has converted an SSB CB (Midland 13-893) to 40 meters. Any assistance will be appreciated.

James Crawford KD5YD
PO Box 643
Lovington NM 88260

I need a manual for the ORD DK-1 keyer. It was made by ORD, Inc., of Fort Worth, Texas, around 1970. I will gladly pay for copying and postage charges.

Bill Unger VE3EFC
RR No. 11
Thunder Bay ON
P7B 5E2 Canada

Data and manuals needed for an Okidata CP-110 dot-matrix printer. I will pay for the cost of copying and postage. I plan to use it with a TI-99/4A Kantronics Interface pack.

James E. Cregger KAØOZB
Rt. 4
Jefferson City MO 65101

Chod Harris VP2ML
Box 4881
Santa Rosa CA 95402

Fig. 1. Isolated Clipperton Island sits 700 miles off the Mexican coast.

CLIPPERTON ISLAND

Clipperton Island. The very name sends chills along the spines of long-time DXers. Clipperton is synonymous with inaccessibility, pirates, danger, and frustration. Once on the top of most-wanted lists, Clipperton has been on the air a total of less than two weeks in the last 25 years. Reports of groups planning to go to Clipperton are second only to Albanian operations as prime discussion in the DX rumor mill. Finally, this spring, more than a dozen amateurs did the impossible and put Clipperton Island on the air as FO0XX, but not without a few reminders that Clipperton is, after all, one of amateur radio's toughest nuts to crack.

Clipperton Island lies in the Pacific due west of San Jose, Costa Rica, and due south of Albuquerque, New Mexico, about 700 miles off the Mexican coast. Its 2 square miles of flat coral and sand surround a nearly-stagnant lagoon, with only one large rock and a few trees sticking up more than a few feet above the tide line. It has no harbor, and landing through its heavy surf is always risky. Even the island's name reflects its sinister nature; it stems from John Clipperton, an eighteenth century pirate who used the island as a base to raid coastal shipping.

Clipperton is now controlled by France and considered part of French Polynesia, but such was not always the case. Since its discovery in 1527, Clipperton has been claimed by Mexico, France, the United States, and Great Britain. Early this century, the king of Italy, Victor Emannuel, was asked to decide whose claim was valid. Apparently not one for snap decisions, the king took more than 20 years to make up his mind in favor of France.

Clipperton has remained uninhabited for most of its history, with a few exceptions. Besides the early pirates, Mexico established a small colony on the island to bolster its claim over the island. Most of the party died when supply ships stopped arriving from the mainland. The US maintained a small base on the island during WWII, but only birds and crabs have called Clipperton "home" since the war.

The First Clipperton DXpedition

Prior to this year's successful DXpedition, Clipperton had only been on the amateur bands three times. The first amateur operation on Clipperton was in the spring of 1954, when a group of Iowa DXers, led by Bob Dennison (now W0DX and VP2VI), hopped in a car and drove to Acapulco, Mexico. The group hired an 83-foot diesel ship and set out for Clipperton. 500 miles out to sea, the ship's navigator tripped over an unstowed transmitter, fell, and broke the ship's only sextant. Since Clipperton is hard enough to find with proper navigational gear, Bob Dennison enlisted the FCC to help pinpoint the ship's location by direction finding techniques. With this help, the hams guided the ship to the right vicinity, but they were unable to spot Clipperton Rock. After sailing around for a few days without locating the island, the ship's captain turned around and steamed back to Acapulco. Clipperton had struck the first blow in what was to be a prolonged battle with DXpeditioners.

Undaunted, Bob and the other Iowa hams tried again the next week, this time with a sailing craft, the *Barca*. The navigation worked this time, and five days after leaving Acapulco, the crew spotted Clipperton Rock just before nightfall. The next morning, however, there was no sign of the island; strong winds and ocean currents had swept the ship well past the island. Unable to fight the combined forces of both wind and current, the *Barca* drifted further away from the elusive Clipperton and finally was forced to call for help.

A ship from the Mexican Navy responded to the distress calls and soon joined the *Barca* around Clipperton. This ship towed the *Barca* upwind to Clipperton and stood by offshore as the amateurs worked their way through the treacherous surf to their landing site. The DXers' troubles were not yet over, however. Their boat overturned in the surf, flooding their generator, which retaliated for its dunking by generating vast amounts of QRN as well as ac. Finally, the overworked generator ran out of oil and stopped permanently.

Meanwhile, a second Mexican naval vessel hove to off Clipperton, bearing supplies for the hard-luck DXpeditioners. Among the supplies was a second generator, but the naval ships had been ordered back to Mexico and wanted the hams to leave the island. Bob Dennison managed to stall for a few more days and made 1108 QSOs as FO8AJ before accepting a tow back toward the mainland. That first Clipperton DXpedition took 22 days and soured the French authorities on the whole idea of amateurs visiting the remote island. Besides a few contacts made during the 1957-8 International Geophysical Year, nothing more was heard from Clipperton on the amateur bands for 20 years.

By the late 1970s, Clipperton was at the top of everyone's most-wanted list. A well-organized group of Swiss, French, and American hams finally assembled the funding, operators, and equipment needed to meet the stiff requirements of the French government, requirements established to prevent a repeat of the FO8AJ troubles. The 1978 DXpedition made about 30,000 contacts, to the great satisfaction of everyone except the Europeans, who never had good propagation to Clipperton.

The 1985 DXpedition

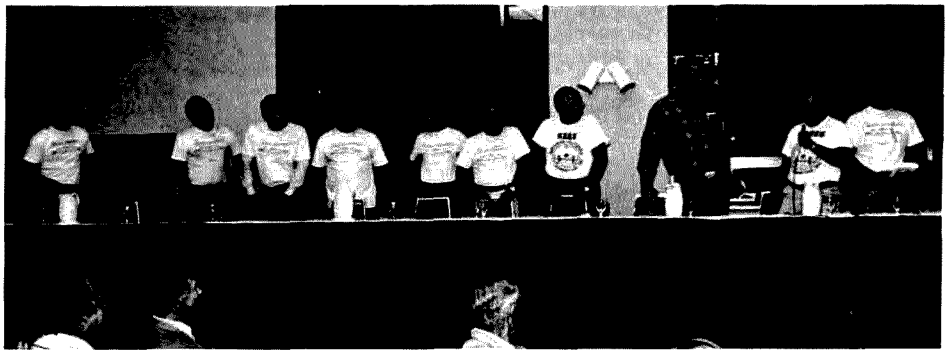
Thanks in part to the success of the 1978 DXpedition, the French government has been more receptive to the idea since that time, and impatient DXers didn't have to wait another 20 years for Clipperton. Only a few years after the '78 trip, amateurs were preparing for the next onslaught on Clipperton. Unfortunately, this latest DXpedition started almost as badly as the 1954 one. The Clipperton DXpedition was originally scheduled for early 1984, and the operators assembled in Mexico in the spring of that year to await their chartered boat. The boat never arrived. After more than a week of sitting around the hotel, the operators reluctantly canceled their plans and returned home. Shades of 1954. They didn't give up, however, and continued to search for a suitable vessel. Once again proving the value of perseverance, the group finally located and chartered the *Royal Polaris*, a fishing craft which had made several previous trips to the area.

Sixteen amateurs from seven countries formed the operating team for the 1985 trip, which set out from Mexico in early April. On the way to Clipperton, the group suffered another disappointment. They had hoped to spend a day on the air from Revilla Gigedo XF4 before continuing on to Clipperton and had obtained a suitable license. Unfortunately, a group of Mexican DXers planned to operate from XF4 at about the same time, so the Clipperton gang's operating permission was for San Benedicto Island only, not the more accessible Socorro Island, from which the XE group would operate. As the *Royal Polaris* steamed around San Benedicto, the DXpeditioners could clearly see that the island had no possible landing, had no way to get operators, generator, and gear to the top of the 200+-foot surrounding cliffs. Maybe next itme, said the operators, as they continued to motor toward Clipperton.

A few days later, on schedule, the *Royal Polaris* dropped anchor off Clipperton. And then the frustration really began. The operators were within sight of their long-sought objective, but the surf pounding on all sides of the island prevented landing. For three days the *Royal Polaris* circled the island, looking for a possible landing spot. The hams considered swimming ashore, but the sharks in the ocean looked even hungrier than the DX sharks on 20 meters. One early attempt to land almost ended in disaster. As their small landing skiff approached the encircling reef, a large wave flipped the craft, dumping the DXers onto the sharp coral. The hams righted their boat and returned to the *Royal Polaris* with only minor cuts, but the incident underscored the dangers of Clipperton's surf.

Finally their luck turned, and the seas calmed just enough to get gear, provisions, and operators ashore. The surf was still too strong to land near the WWII base, from which the 1978 crew operated. This year's Clipperton DXpeditioners pitched their tents on a narrow strip of sand near some coconut trees and hard by an abondoned ammo dump. As it turned out, the only explosions were on the ham bands, whenever FO0XX appeared.

Once ashore on Clipperton, the DXpedition proceeded as planned, with only an occasional visit from Murphy. Their Cushcraft AV5 verticals and A3 tribander survived the high winds, heavy rains, and salt spray that plague the island. For generators, the group chose Chinese diesel models, which used the same fuel as the *Royal Polaris*. These all-important items performed well throughout the DXpedition. Aside from the minor glitches expected in so complicated an endeavor (plugging a 110-V amp into a 220-V generator, using a 15-meter W3LPL narrowband filter on 40 meters, etc.), the amateur-radio



Some of the Clipperton DXpedition team, still sporting Clipperton tans only days after their return.

side of the DXpedition proceeded smoothly, and the operators kept stations on every open band. And as one well-tanned operator remarked upon his return, "The pileups were worth the trip!"

The island was less attractive between operating shifts. Although the group at first ate well, including steak and fresh fish, the trip was no picnic. 10-40-mph winds whipped tent flaps, food, and anything not tied down. Temperatures in the 80s and 90s and very high humidity combined with blinding sun to make daytimes unpleasant. Grade 15 sunscreens were the order of the day. At night, heavy rains flooded the tents (at least they had plenty of fresh water!). The famous Clipperton crabs invaded their camp in force, eating just about anything that didn't move, including toes. But the real problem was the birds. Lots of birds. Hundreds and thousands of birds, each apparently aiming at the DXpeditioners and their tents. Judging by the condition of the tents after only a few days, it is no wonder that Clipperton was once a major source of guano. The 16 DXpeditioners, not in the mood to be mined for their guano deposits, took a dim view of their feathered friends. Such is the lot of the serious DXpeditioner.

Bob Vallio W6RGG survived his FO0XX experience, but he has no plans to return.

A Harrowing Moment

The group was prepared for unwanted visitors, as they remembered the pirates that other DXpeditioners encountered on Palmyra Island, not to mention Clipperton's namesake. For a moment it looked as though these preparations were well-founded, when a small helicopter circled overhead and started dropping small bombs. Everything turned out for the best, however, when the hams discovered the helicopter's passenger was a fellow amateur from a Mexican fishing vessel in the area. The bombs were used to scare birds away from beneath the helicopter, not to frighten the DXers. Amateur radio's spirit of international cooperation prevailed, and soon the Mexican ham offered to replenish the DXpeditioners' fresh vegetable supply and won everyone's gratitude with a case of *cold* beer!

All too soon the time came to pack up and leave Clipperton to the birds and crabs. And once again Clipperton proved to be formidable. As the DXpeditioners started to strike their camp and prepare for the difficult passage back to the *Royal Polaris*, the surf once again rose to unmanageable levels. A day went by, and then another. The crew began to wonder when they would be able to leave Clipperton. The fresh food gone, they were living on freeze-dried foods and what fish they could catch. Finally, on the third day after deciding to leave, the seas calmed sufficiently to try to leave. As the DXpeditioners ferried themselves and their gear out past the reef to the *Royal Polaris*, the surf upended one of the skiffs, dumping hams and rigs into the sea. Fortunately, no one was injured, and the sharks kept their distance. As they left Clipperton, a shaken member of the DXpedition remarked, "If we hadn't gotten off the island when we did, we wouldn't have gotten off at all."

Operating Results

The DXpedition was quite a success, despite the delay of a year and the difficulties getting on and off the island. The crew made almost 31,000 contacts, meeting their goal of more QSOs than any previous DXpedition to the island. Their contacts were split about 2:1 in favor of single sideband, on every band except 40. As expected, 20 meters provided the bulk of the contacts, with more than 11,600 QSOs. Reflecting the decline in sunspots, the crew made almost three times as many contacts on 80 meters as on 10. They even made about 100 contacts through Oscar 10, providing some satellite enthusiasts with a unique opportunity.

The 31,000 contacts included QSOs with hams in 130 DXCC countries, on all continents. The pileups never stopped, but the operators did their best to work as many deserving DXers as possible, as fast as 300 contacts per hour under good conditions. At times, the only way to keep order in the pileup was to work stations by call areas. And the operators noticed an interesting change in the Japanese operators when Clipperton DXpeditioner Kay Saki JG3LZG took the mike. As soon as Kay started talking in Japanese, the normally well-disciplined JAs broke into a chaotic rabble! Nevertheless, most amateurs who needed Clipperton had ample opportunity to log one of amateur radio's rarer QTHs. The only exception was the same group who missed the 1978 trip: the European amateurs. Once again, propagation did not favor Europe, and many Europeans will have to wait a few more years for their FO0X QSL card. If you were among the more fortunate DXers who did work FO0XX, QSL via the Yasme Foundation, PO Box 2025, Castro Valley CA 94546.

These 30,000+ contacts came at a total cost of almost $3/QSO. About a third of the cost was covered by donations of equipment and money, but the DXpeditioners themselves picked up the majority of the costs. Stay-at-home DXers wanting to help defray the costs of the trip and help ensure the success of future DXpeditions to Clipperton and elsewhere can send a contribution to the Northern California DX Foundation, Box 2368, Stamford CA 94305. Or you might consider joining the Clipperton DX Club, for $17: Contact Patrick Bittiger F6EYS, 8 rue du General Ganerval, 67000 Strasbourg, France. Or add a small contribution to the cause to your QSL request.

The 1985 Clipperton DXpedition is now history, with only slides and QSLs to mark the event. For those DXers who missed this chance to confirm FO0X, the wait for the next amateur operation from Clipperton may be quite long, certainly several years. And will any of this year's veterans join the next trip? "No Way." "Never Again." "You've got to be kidding." Apparently one visit to amateur radio's hard-luck island is enough for everyone.

Thanks to July, 1954, *QST*; April 1, 1985, *QRZ DX*, and the Clipperton DXpeditioners for their assistance with this column.

BE MY GUEST

Guest Editorial by Donald Chester K4KYV

AM IS BACK

In tuning across the HF phone bands, many amateurs seem surprised when they learn that there is a substantial amount of AM phone activity on the air. Indeed, amidst all the discussion about stagnation in amateur radio, AM seems to be the one specialty interest which is actually growing at the present time. Those who take the attitude that amateurs who still operate AM are merely diehards who ignore the realities of today's technology have missed the point entirely.

Present-day AM operators may choose to use this mode for a variety of reasons. Undoubtedly, some are old-timers who simply enjoy the nostalgia of pulling their 30-year-old Globe Kings and BC-610s out of the closet and firing them up. Nevertheless, upon listening to AM QSOs in progress, one soon discovers that a large percentage of the AMers are young—some still in high school. Astounding as it may seem, AM operators frequently discuss such topics as building, repairing, and modifying transmitters and receivers and experimenting with circuits; there are even some home-brew rigs on the air! Some of these amateurs are audiophiles whose challenge is to achieve superb voice quality. Others appreciate working at a level of technology wherein the average amateur without a degree in engineering can get the feel of meaningful hands-on experience inside a piece of radio equipment. Some of the AMers simply got bored with mainstream amateur radio and decided to try something different. Others may be found up to their elbows in high-tech, experimenting with such innovative circuitry as pulse-duration modulation and synchronous detection.

Section 97.1 (c) of our rules lists as part of the basis and purpose of amateur radio "...advancing skills in both the communication and technical phases of the art." This means that amateur radio is intended to serve in part as a means by which an individual can provide self-instruction in the radio art. AM technology is one of the basic foundations upon which much of today's high technology is built. The amateur's self-instruction may range anywhere from experimenting with the elementary fundamentals of modulation all the way to spread spectrum, packet radio, ACSB, and other marvels of the 1980s. Now, any college math student will agree that one cannot feel comfortable with differential equations without having first mastered the calculus, and that would be impossible without a strong background in algebra and arithmetic. No wonder there is widespread concern about the present-day amateur's lack of interest in building and experimentation. Is one to be labeled a "diehard" for not expecting a newly licensed General with no prior hands-on experience to immediately dive into digitally-controlled phase-locked loops?

Perhaps the most convincing evidence that AM is alive and well, other than actually hearing the AM signals on the air, can be found by glancing through the ads in a recent issue of any of the popular amateur-radio magazines. You will notice that most of the imported HF transceivers now include the AM mode along with CW, FSK, SSB, and FM. This wasn't true five or ten years ago. Let us be realistic; it would be inconceivable for these large manufacturers serving major markets throughout the world not to use some sort of marketing research to determine consumer demand. Since these companies are very cost competitive with each other in what appears to be a dwindling market, they would not be raising the retail prices of their radios by as much as $100 each in order to include AM transmitting capability if they were not convinced that there is indeed a market demand for amateur-radio products which include the AM mode.

Those who oppose the use of AM on the amateur bands usually argue that the double sideband signal, with twice the nominal bandwidth as SSB, takes up too much spectrum in today's "congested" bands. If the one and only justifiable goal of amateur-radio experimentation is spectrum conservation and generating the narrowest possible signals, then perhaps voice operation should be eliminated entirely. Five to ten CW stations could simultaneously operate in the space occupied by *one* SSB signal. Besides, everyone agrees that CW penetrates the QRM and QRN better than SSB, AM, or FM. Of course, CW is much slower than voice, but that is one of the penalties we must pay for spectrum conservation. With today's technology which includes computers and interfaces, keyboards, code readers, and exotic RTTY systems such as AMTOR, many of the drawbacks formerly associated with "CW" communication can now be overcome by high-tech. The new 10.1-

10.15-MHz band has already set the precedent. Think how many more signals could be crammed into the existing HF amateur bands if they were all CW only!

Seriously, of course, none of our modes should be eliminated. Many of us operate voice because we find it more enjoyable than manipulating a telegraph key or typing out messages on a keyboard, despite the fact that even SSB uses more spectrum. Some of us prefer AM over SSB for precisely the same reason others prefer SSB over CW! Why should the limit to preference vs. spectrum economy be arbitrarily set at the bandwidth of SSB? While a clean SSB signal takes the bandwidth of at least five CW signals, the bandwidth of a clean AM signal only takes twice the bandwidth of an SSB signal.

One of the unique features of the Amateur Radio Service is the wide variety of frequencies and emission modes available for communication and experimentation. In 1981, rejecting a petition (RM-3665) which sought to phase out AM, the FCC stated that "The Commission's aim is to provide the amateur radio operator with diverse modes of communication for experimentation rather than to restrict him/her to certain specific methods of communication."

Today there is serious concern over the stagnation in growth of amateur radio. Unfortunately, a commonly expressed attitude is that "only *my* specialized interest in amateur radio is worth preserving, so I don't care if your favorite activity is eliminated." Such griping is likely to turn off any potential newcomer who might happen to be tuned in to the conversation, in addition to the deliberate interference and jamming, racial and ethnic slurs, foul language, insults and threats, and arguments over frequencies, etc., which have become so common on the voice bands today. Interestingly, very little of this behavior is heard coming from the AM stations. There is room in our bands for all the legal modes of emission and diverse operating activities presently enjoyed by amateurs. We should all be pleased that the AMers are on the air and displaying a little genuine interest in the technical side of radio.

Most of the AM activity is voluntarily restricted to small, specific portions of the bands. Close examination of most of the complaints about QRM, AM or otherwise, will reveal that someone was likely offended because another amateur dared to transmit on his self-proclaimed "private" frequency, which was probably idle at the time. Is it that some of the "state-of-the-art" rigs in use today lack vfo's and must operate crystal-controlled? Regardless of the mode in use, interference can be kept to an acceptable level simply by observing good operating procedures.

The AM community cordially invites all amateurs to listen in sometime. The most popular AM operating frequencies are: 1880-1900, 1985-90, 3870-85, 7285-95 kHz, and 29.0-29.2 MHz. You just might like what you hear and develop an urge to turn the mode switch on your "all-mode" transceiver to the AM position and fire up.

Donald Chester K4KYV is editor of The AM Press/Exchange, *a monthly newsletter devoted to AM operation.*

FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

LOGIC PUZZLES

This month, for a change of pace, let's try our collective hands at some logic puzzles. While hams may not be the most logical bunch of people in the world (if we were logical, we wouldn't be clinging to the Morse code, right?), our technical skills do endow us with a certain degree of rationality. Anyway, logic puzzles make a nice break from the usual collection of multiple choice and matching questions. Have fun and don't think too hard.

QUESTIONS

1) Stan, an avid DXer, packs all of his QSLs into cartons that hold 16, 17, 23, 24, 39, and 40 pounds of cards. Old Stan's a little peculiar in that he will only use boxes of those sizes. He also fills each box to its full weight limit. Stan now wants to send 100 pounds of cards to the ARRL for DXCC credit. Tell us how many boxes and box sizes he will require. Oh yes, Stan has an unlimited supply of cartons of each size.

2) The president of the Skunkhaven Repeater Society took $60 out of his own wallet and purchased a supply of official club jacket patches. Fifteen of the patches were reserved for possible future members while the remainder were sold to the club's members for a total of $54, netting the president a 10-cent profit per patch. How many patches did the president purchase?

3) Last year's Rhode Island Sweepstakes was a fascinating and exciting single-operator competition—two solid weeks of contesting with only a two-hour break every 24 hours. Unfortunately, the lack of sleep eventually got to the participants and they all accidentally destroyed their logs (talk about a coincidence!). Luckily, however, each of the contesters was able to recall two aspects of the final results. Unluckily, though, most of the participants had lousy memories. When all was said and done, the only station that remembered two correct facts finished first. The only other contester to correctly recall a participant's final standing finished second. Your job is to determine the position of each station in the final standings.

N1ZAZ	KF1AM finished second WU1UU finished fifth
KF1AM	WU1UU finished first KT1RAX finished second
KT1RAX	NN1Z finished first WF1PU finished sixth
NN1Z	N1ZAZ finished first KT1RAX finished fourth
WF1PU	KF1AM finished fifth NN1Z finished third
WU1UU	WF1PU finished third N1ZAZ finished fourth

4) Herb and Dave are traffic handlers. Together they can handle 512 messages in 24 days. If Herb can only handle two-thirds as much traffic as Dave, how long would it take each of them to handle the messages alone?

5) It's Field Day! AF2M is a helpful young man who likes to help others erect their antennas. On this day, however, he was asked to pound some grounding rods in a circle around an antenna. AF2M discovered that if he pounded the rods one foot apart he would have 150 too few rods (it was a big array). If he placed the rods a yard apart he would have 70 too many. How many rods did AF2M need?

6) Three HTs and one VHF transceiver cost as much as two HF rigs. One HT, two VHF transceivers, and three HF rigs sell together for $2500. What is the price of each radio?

7) Frank owns two dummy loads: one for his multimode 2-meter rig, the other for his low-band transceiver. The VHF load is filled to one-third capacity with mineral oil. The low-band load, the same model and capacity as the VHF device, is filled to one-fourth capacity with mineral oil. Frank is cheap and insane, so he decides to bring each dummy load to capacity with transformer oil. He then empties the two loads into a large container and pours half the mixture into one of the empty dummy loads. Tell us what proportion of this mixture is mineral oil and what part transformer oil? (Note: the two oils mix perfectly, and please don't try this yourself!)

ANSWERS

1) Stan needs four 17-pound cartons and two 16-pound cartons.

2) The president bought 75 patches at 80 cents apiece ($60). After keeping 15 patches, he sold the remaining 60 for 90 cents apiece ($54). His profit, therefore, was 10 cents per patch on the 60 patches sold.

3) First—WF1PU, Second—WU1UU, Third—NN1Z, Fourth—N1ZAZ, Fifth—KF1AM, and Sixth—KT1RAX.

4) It would take them 60 days and 40 days.

5) AF2M needed 180 rods. The circumference of the circle was 330 feet.

6) The HT costs $200, the VHF transceiver $400, and the HF rig $500.

7) The concoction will be 7/24 mineral oil and 17/24 transformer oil.

SATELLITES

USING THE AO-10 APOGEE PREDICTIONS

Apogee predictions for the month of July are provided for three sections of the United States: Washington DC at 39N 77W, Kansas at 39N 95W, and California at 38N 122W. Times are in UTC and apogee in this case is mean anomaly 128 rounded to the nearest whole hour. Use the chart as a guide in aiming your antenna, then line-tune the azimuth and elevation values to peak the satellite's beacon signal. If you require more accurate orbital predictions, contact AMSAT at PO Box 27, Washington DC 20044.

AMSAT-OSCAR 10 APOGEE PREDICTIONS
JULY 1985

			WASH		KANSAS		CALIF	
ORBIT	DAY	TIME	AZ	EL	AZ	EL	AZ	EL
1871	1	0900	180	31	158	28	130	16
1873		0800	165	31	145	25	121	9
1875	3	0700	152	29	133	20	112	2
1877	4	0700	147	24	130	14		
1879	[illegible]	0600	135	19	121	8		
1881	6	0500	125	13	112	1		
1883	7	0500	123	7				
1884	7	1600					249	0
1885	8	0400	114	1				
1886	8	1500					242	9
1888	9	1500					236	10
1890	10	1400			248	0	228	18
1892	11	1300			241	8	218	26
1894	12	1300			235	10	211	26
1896	13	1200	241	6	227	18	199	31
1898	14	1100	233	14	217	25	185	34
1900	15	1100	227	15	210	25	178	31
1902	16	1000	217	23	197	30	164	31
1904	17	0900	206	29	184	32	150	28
1906	18	0900	198	28	177	30	146	23
1908	19	0800	185	31	163	29	135	18
1910	20	0700	171	32	150	26	124	12
1912	21	0700	165	28	146	21	122	6
1914	22	0600	152	25	134	17	114	0
1916	23	0500	140	21	124	10		
1918	24	0500	137	16	122	5		
1920	25	0400	127	10	114	0		
1921	25	1500					252	0
1922	26	0300	117	3				
1923	26	1500					246	2
1924	27	1400					240	7
1926	28	1400					234	8
1929	29	1300			245	0	225	16
1931	30	1200			238	6	215	23
1933	31	1100	244	3	230	15	204	29

NEW PRODUCTS

HILDRETH ENGINEERING CW FILTER

The Model 10 Super CW audio filter is now available from Hildreth Engineering. Two modes of operation allow the user to select either a normal filter or a filter with signal-to-noise (S/N) enhancement. The audio filter is an eighth-order Butterworth with a 3-dB passband from 700 to 800 Hz, and a 3–30-dB shape factor of less than 3. The S/N enhancement function provides a 10-dB S/N ratio improvement over operation with just the audio filter. A 2-Watt audio amplifier is also included, which will drive a 4-8-Ohm speaker.

Further information may be obtained by writing *Hildreth Engineering Corp., PO Box 60003, Sunnyvale CA 94088.*

YAESU FRG-8800 RECEIVER

Yaesu's new FRG-8800 HF receiver covers 150 kHz through 29.99 MHz. Direct frequency entry is provided via the front-panel keyboard, which also controls scanning functions and storage/recall of the memory channels. The green LCD information display provides frequency, mode, and signal-strength information. Selectable agc, all-mode squelch, two 24-hour clocks, and recording capability (including on/off timer switching) make for maximum operating flexibility. The FRG-8800 is designed for easy interface with a personal computer for expanded operating control, and the FRV-8800 VHF Converter option expands coverage to include 118–174 MHz, with front-panel frequency entry and display.

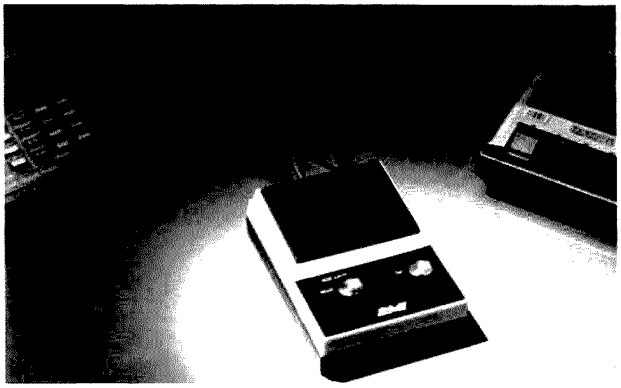
For further information, contact *Yaesu Electronics Corporation, PO Box 49, Paramount CA 90723; (213)-633-4007.*

Yaesu's FRG-8800 communications receiver.

NITELOGGER VOICE-ACTIVATED INTERFACE

BMI, Inc., has announced the development of a new tape-recorder activator accessory designed to make recording scanner-radio activity easier and more convenient. NiteLogger™ plugs in between a scanner and any standard cassette recorder. No external relays or impedance-matching devices are needed. Voice-relay (VOX) operation permits recording of up to seven days or more of messages on a single C-90 cassette tape, depending on average channel use. NiteLogger includes a VOX-level LED indicator, which assures perfect adjustment, a VOX-delay control which minimizes dead tape time and annoying tape-recorder start/stop noises, and a built-in speaker system that allows monitoring of scanner reception during recording. The monitor's volume control is independent of the recording level so the user can select anything from full volume to silence without affecting the volume of recorded messages.

For more information, write *BMI, Inc., 65 East Palatine Road, Prospect Heights IL 60070.*



The BMI NiteLogger.

FREE TOOL AND INSTRUMENT CATALOG

Contact East is offering their 1985 electronic tool and test instrument catalog, featuring over 5,000 technical products for assembling, testing, and repairing electronic equipment. Products include precision hand tools, test instruments, tool kits, soldering supplies, and a full selection of telecommunication tools and instruments.

The Contact East 1985 catalog is available free from *Contact East, 7 Cypress Drive, PO Box 160, Burlington MA 01803; (617)-272-5051.*

ADTECH SWITCHING SUPPLY

Adtech Power has announced their newest Switcher Model Power Supply, the CS-1307. This 50-Watt, 3-output MOSFET supply uses a 50-kHz operating frequency in a fly-forward topology.

Many output combinations are available; a common combination is +5 V @ 4 Amps, +12 V @ 2 Amps, and −12 V @ 0.5 Amps. The standard size is 5.25" × 3.75" × 2.0". A breakaway tab arrangement on the PCB allows users to reduce width to 3.25" when space is a problem.

For more details, contact *Adtech Power, 1620 South Sunkist Street, Anaheim CA 92806.*

BRAILLE DISPLAY PROCESSOR

A device with an electronic braille display, providing instant personal-computer access for blind persons, has been developed by Visualtek, Inc., of Santa Monica, California. The Braille Display Processor (BDP) gives blind individuals easy access to column-oriented information useful for spreadsheet and programming applications, as well as a wide variety of other computer uses.

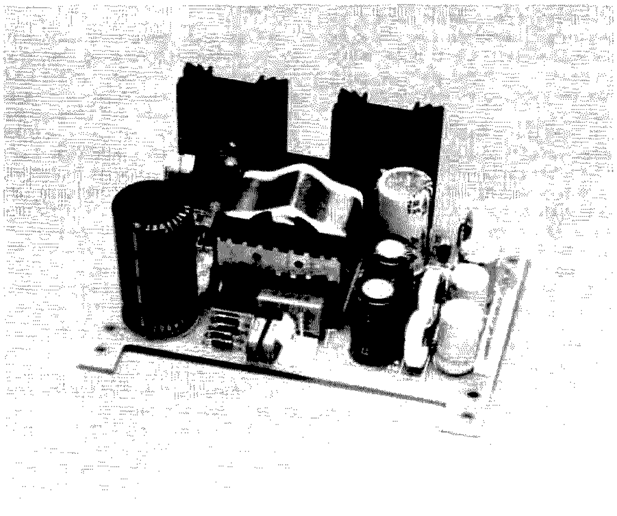
The BDP is available in two models: the BDP-20 for use with the Apple II, II+, or IIe, and the BDP-21 for use with the IBM PC and PC/XT, or compatible PCs. The BDP allows blind users to read the computer display on a 20-cell refreshable braille window in user-selectable 6- or 8-dot computer braille.

For more information, contact *Visualtek, 1610 26th St., Santa Monica CA 90404; (213)-829-6841.*

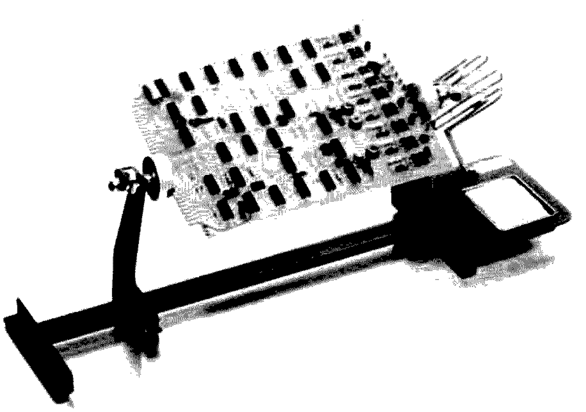
DAVLE TECH PC STATION

The Model PCBH-50 is a rugged printed-circuit-board holder and solder station designed especially for laboratory, prototype, and repair work as well as light production applications. Self-locking end supports slide easily to suit the board's width. The board holders are spring-loaded for easy board removal and replace-

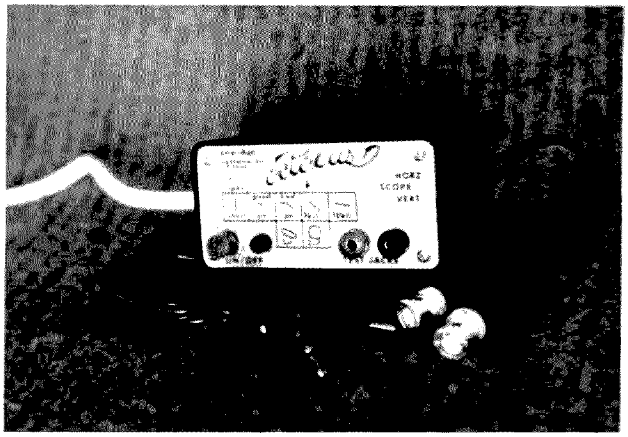
Visualtek's Braille Display Processor.



The Adtech CS-1307 switching power supply.



The PCBH-50 work station from Davie Tech.



The Octopus from Jensen Tools.

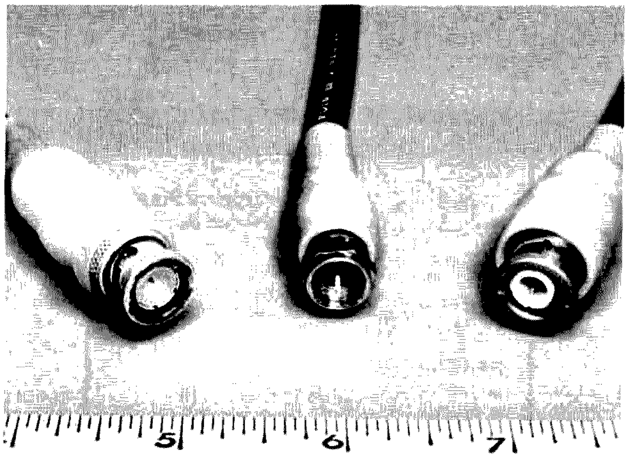
ment without readjustment. The board may be rotated a full 360° for easy access to both sides and may be locked at any angle for optimum efficiency. The PCBH-50 includes a specially-designed soldering iron holder which holds a soldering iron safely and a tip-cleaning sponge for added convenience and improved productivity. The unit is free-standing or may be mounted to a workbench. The PCBH-50 will hold boards up to 10 inches × 12 inches.

For more information, contact *Davie Tech, Inc., 2-05 Banta Place, Fair Lawn NJ 07410; (201)-796-1720.*

COMPU-FIRE EXTINGUISHER

The Compu-Fire™ is a rechargeable fire extinguisher for microcomputers, printers, and peripherals. Only 10 inches tall and weighing 2¼ pounds, the unit contains 20 ounces of Halon 1211, an agent which produces no static electricity upon discharge and which leaves no residue to harm electronic components. The extinguisher features a chrome-plated DOT steel cylinder, an aluminum valve assembly, and a pressure-indicating gauge. It carries a U.L. rating of 2B:C and a manufacturer's 5-year limited warranty. On the front of the cylinder are pictorial instructions for use, as well as a pictogram indicating its suitability for computer fires.

For further details, contact *Protectall Corp., 5422 Page Drive, Pittsburgh PA 15236; (412)-882-0114.*



Weather boots from Kilo-Tec.

KILO-TEC WEATHER BOOTS

Kilo-Tec is now offering weather-resistant boots for use with BNC, UHF, F, and N connectors on RG-58, RG-59, or RG-8X coaxial cable. The boots, designed to keep connections clean and dry, are made of a flexible vinyl material that resists moisture and that will not break down when exposed to the sun's rays. Custom boots are also available for other combinations of connectors and cables.

For more information, contact *Kilo-Tec, PO Box 1001, Oak View CA 93022.*

OCTOPUS TROUBLESHOOTER

Jensen Tools has announced the Octopus, a device which provides a fast, efficient method of troubleshooting electronic assemblies to the component level, both in and out of a circuit. When used in conjunction with a dual-trace oscilloscope having an X-Y function, or with a single-trace scope that accepts external horizontal-sweep output, the Octopus generates a 60-Hz sinusoidal test signal of approximately 3 V p-p. When this signal is applied to the component under test (resistor, capacitor, semiconductor, inductor, etc.) it will display the component's current/voltage response on the oscilloscope. By comparing a suspect component's trace to a good component's trace, the bad component can be quickly identified.

For more information or for a free catalog of other test equipment and hard-to-find tools for electronic assembly, troubleshooting, and repair, write or call *Jensen Tools, Inc., 7815 S. 46th Street, Phoenix AZ 85040; (602)-968-6231.*

REVIEW

THE HAL CWR6850

I am a closet RTTY enthusiast. Were you to ask, I would vehemently deny any interest in things digital, but at night, alone in my shack, I secretly tune in those weedle-deedles as my eyes grow glassy. I've even memorized the sound of CQ and RYRY.

So you can imagine my excitement when a traveling ham dropped by the office, driving an RV that sprouted antennas of various shapes and sizes.

"I've got a complete amateur station set up in there," said the visitor, "all bands, all modes, even RTTY. Wanna see it?"

My heart jumped. "Oh, sure, why not?" I replied coolly.

Inside the van was a complete ham setup, and those wonderful RTTY burbles were coming out of a small grey box on the table. A week later a Hal CWR6850 graced my operating position.

What It Is

The Hal CWR6850 is a complete, portable RTTY/CW transceiver. It will send and receive Murray or ASCII at 45, 50, 57, 75, 110, and 300 baud, although an external modem is required for 300-baud operation. My unit came with three sets of specifications, and there is a disparity of CW rates among them. One lists 25- to 200-wpm receive and 15- to 250-wpm send. The second claims 3- to 40-wpm receive and 4- to 33-wpm send. In the third, it's 1- to 100-wpm receive and 4- to 33-wpm send. In practice, though, speeds above 60 wpm are pretty much all the same. The unit goes really slow (time for coffee between characters) to really fast (unintelligible buzzing). The CW-receive algorithm automatically tracks the incoming rate. Besides all of the normal Morse numbers and letters, the CWR6850 recognizes apostrophes, colons, parentheses, quotes, and several prosigns. Power requirements are 12 volts at 1.6 Amps.

Three RTTY shifts are provided: 170, 425, and 850 Hz. Either high (2125-Hz mark) or low (1275-Hz mark) tones may be selected. The center frequency for CW reception is 800 Hz.

On the front panel, push-button switches (there are 24) offer easy access to the most-used parameters such as speed, shift, and mode. A three-position toggle switch sets the unit into either manual send, manual receive, or automatic send and receive. Four slide potentiometers control input volume, monitor-output volume, CW transmit speed, and frequency fine-tuning. The green-phosphor CRT displays 20 lines of 32 characters per line on each of four pages.

The rear panel sports eighteen jacks and three controls. This may seem rather a large number of things to hook up, but a working RTTY station may be configured using only two connections: audio input and RTTY output. The plentitude of ports is the key to the CWR6850's flexibility. There is literally no limit to the varying combinations of options that may be chosen—from a simple two-wire system to a complex full-blown RTTY gargantua. The unit will interface with virtually any rig you can think of.

Operation

I was relieved to discover that the CWR6850 is not as difficult to use as I had first imagined. All of the switches and jacks were a bit intimidating, but in true ham fashion I set the unit up without cracking open the manual. In about ten minutes I had unpacked the box, hooked up an external 12-V-dc supply, run the appropriate (I hoped) cables to and from my ICOM IC-701, and said a short prayer. Surprise! It worked!

Now for the real fun. Tuning across the 20-meter RTTY subband, I was delighted to see the Mark and Space LEDs spring to life as I settled in on a strong CQ. I copied the call carefully on a scrap of paper and waited for the fellow to sign. There—now his call, my call...wait! Nothing's happening! I reluctantly dug around the shack looking for the instruction manual.

I ended up reading nearly the *entire* operation manual. So often a manufacturer produces a marvelous piece of equipment, spending who knows how many thousands of engineering hours, then hires a tenth-grader to write the technical manual for the thing. Or worse yet, the gear is imported and the tenth-grader translates the manual from Japanese. Hal's instructions were written by someone who a) knows everything about the product and b) writes English like a native. This is a *three-star* manual.

But I digress. The no-transmit problem was quickly resolved and I hit the bands. This time the lights blinked, the rig keyed, and I was in QSO! What a pleasure...the top half of the split-screen displayed incoming text while I composed my reply on the bottom half. Keyboard action is smooth, and it took some serious pounding to keep the transmit buffer full at 60 wpm. Occasionally, my mind would simply lock up, and I would stare blankly at the keys trying to find a letter. The CWR6850 would drop into receive and the other fellow would think I had turned things over. It made for some really interesting conversations.

Free Advice

The big question these days, is, "Should I buy a dedicated RTTY system or a computer with RTTY software?" Of course, there is no one-size-fits-all answer, but here is some advice to help you decide:

Consider to what extent you would like to be involved in amateur RTTY. A serious RTTY enthusiast will go for the dedicated system every time. Why? Well, a unit like the CWR6850 has been engineered for one use: RTTY. The hardware and software will consistently outperform a computer/interface combination, particularly when conditions are marginal. It's like using a UHF transverter on your HF rig: Sure, you can get on the air and make a few contacts, but it just isn't the same as using a station designed specifically for UHF. A computer will do the job, but after a while you are going to want more performance than the machine is prepared to give.

If you are a first-time RTTYer or plan only spotty RTTY operation, consider an inexpensive computer teamed with a simple interface. And I mean really inexpensive: You can assemble a working RTTY station for under $40 these days. Just remember the price tag when the gear copies only S9 + 40-dB signals!

Finally, decide how much you are willing to spend on your equipment. The Hal CWR6850 costs $750. A home-computer-based system that will match the CWR6850's performance will cost quite a bit more than that. And if you want to operate RTTY mobile or portable, a computer falls flat on its glass face. The CWR6850 is *designed* for just such activity. Remember—don't decide what to buy based on price alone. Weigh the unit's features and your requirements against your pocketbook.

Final Thoughts

Hal's CWR6850 does its job extremely well. It will copy just about everything you can hear, under conditions that send most add-on terminal units packing. Commands are simple and sensible, and the equipment has that "feel" of quality sadly lacking in much of today's gear. The manual is the best I've seen in a long time.

If you already are active on RTTY, consider the CWR6850 when it's time to upgrade your equipment. If you are unsure of which direction you want to go in assembling a RTTY station, take the time to write the folks at Hal. They are incredibly nice, and will help you decide just what it is you need to get on the air. Their address is *Hal Communications Corp., Box 365, Urbana IL 61801.*

Perry Donham KW1O
73 Staff

CES 510SA SMART PATCH

After a rather extended period of testing, I can say that the Smart Patch is quite a device. It performs very well and I think not only should it do quite nicely as a simplex patch, but also as a repeater's autopatch. A look at the features will show you what I mean.

For starters, the Smart Patch is microprocessor-controlled, making it an intelligent device. Normally a full-duplex device, you can disable this feature and set it up for half-duplex operation so it can be used in a repeater. I didn't have a chance to test this option since my repeater already has an autopatch, but I think that it should perform quite well in that situation. It did well on a simplex frequency, using a normal VHF two-meter FM mobile rig and an ICOM IC-22U in the shack.

Standard features on the Smart Patch also include single-digit (* or #, for example) or multi-digit control codes. And if the disconnect code is sensed from your mobile station, the CW ID built into this unit will sound to let you know that you're in range. Another feature is the ability to toll-restrict, and the timeout signal is a unique warning beep. The timeout can be enabled or disabled with the * sign. You can also select tone or rotary dialing, and a special detection circuit prevents the interruption of a call in progress. If someone tries to interrupt it, the Smart Patch will send a CW sequence. A touchpad-accessible code allows full access to the phone line for emergency calls.

The Smart Patch will act not only as a phone patch, but also as a reverse patch. A special CW sequence alerts you to the presence of a call, although the intelligence keeps the unit from transmitting if it senses someone is on frequency. It waits until the carrier drops before it transmits.

Since this unit is meant to operate in the full-duplex mode, transmit and receive sampling are built in. You can't detect the sampling as the unit swings from the telephone side of the conversation to the mobile-transceiver side of the conversation. The sampling rate, which is built into the firmware—programming—of this unit, is variable from about 150 ms to 1 second. It's fast enough that you can use this unit in the duplex mode. A VOX circuit monitors the received telephone audio and lengthens the sampling interval to minimize any losses from slow-switching radios.

This covers the basics of the Smart Patch. When you pop the covers of this unit you will see it is well made. The components are mounted on a high-quality printed circuit board and good construction techniques are used throughout.

In operation, the transceiver to which this unit is connected is held in receive. When the connect code is detected by the Smart Patch, the base unit transmits the dial tone back to your mobile rig. The carrier will be interrupted periodically as the base switches from receive to detect if the mobile unit is transmitting. If the mobile unit is transmitting during this sampling period, the base unit will lock into receive and hold the phone line.

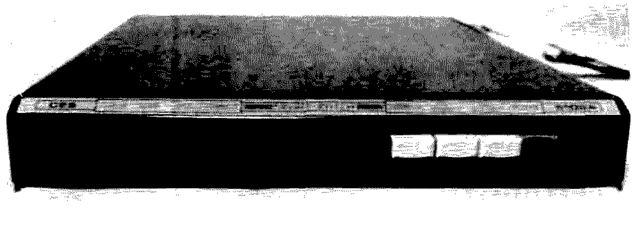
About the only thing for the mobile operator to remember during all of this is that after keying the transceiver he must pause until the next sampling period before dialing or speaking. However, this isn't a drawback since the sampling rate is at least every second or quicker on some radios.

When the mobile unit drops, the base will resume transmitting and sampling. And when the conversation is finished, the disconnect code is used to disconnect the patch.

That's all there is to it and I found during testing that the unit performs pretty smoothly.

For review purposes, we interfaced an ICOM IC-22A with the Smart Patch. The Smart Patch came equipped with a multi-colored ribbon cable and connector for the ICOM's accessory socket. The instruction pamphlet clearly stated that only a few simple hookups were needed to make this unit work. However, we found this wasn't the case.

You must not only find a place to tap 12 V dc to power this unit, but you must also find a place to tap the push-to-talk line, ground, and mike audio. Most are readily available on the microphone connector. But the discriminator audio tap required



CES 510SA Smart Patch

several calls to CES before I could set it up. I eventually used the accessory terminal board for the connection and had to take a jumper from there to the accessory socket, as I did for the rest of the connections. One would think this could be done much more simply, as there are other units on the market which require connections to push-to-talk and transmit and receive audio, and that's all. It wasn't as easy a job as the instructions made it appear, but once the connections were made, it performed as advertised.

Programming this unit was handled via DIP switches on the circuit board and it was easy to handle.

The operational instructions for the CES Smart Patch were complete and easy to read. They assumed a degree of technical knowledge which was a welcomed change from other instruction manuals I have read recently, which seem to assume that all you know how to do is plug in the mike and power cables. In fact, some don't even assume you know that, but that's not the case with the CES Smart Patch.

Overall, the CES Smart Patch is a quality instrument. At $349, you will find it a good investment.

For more information, contact *Communications Electronics Specialties, Inc., PO Box 2930, Winter Park FL 32790; (305)-645-0474* or *(800)-327-9956*.

Marc Stern N1BLH
Framingham MA

HAMLOG—COMMODORE SOFTWARE

Computers do certain things very well. Storing and shuffling records around is one of them. Even though requirements for keeping a logbook were reduced and then all but eliminated in the ham shack, almost all amateurs keep a log of some kind.

Paper records are cumbersome and have a way fo getting lost, soiled, or faded. Computers in the ham shack promise to do away with some of these problems.

One of the many entries into the amateur-radio software field is HAMLOG. Their electronic logbook is available for the Commodore 64 and VIC-20 (with a minimum of 8K of expansion). HAMLOG is priced at $24.95. Both programs require a disk drive. HAMLOG comes with fourteen pages of documentation.

The program is contained on two disks. More accurately, the program is on one disk, with data stored on a second disk. The program disk auto-runs, eliminating the need to manually start the program. The same procedure also keeps you from having a look at the program itself. HAMLOG is copy protected allowing no easy way to back up your purchase. The program carries a 30-day warranty. After that you are on your own.

The data disk will allow you to create 700 entries or "log cards" as they are called. Additional data disks go for $5.00 each to registered owners only.

The overall appearance of HAMLOG is quite nice. It displays well on the screen and the prompts are clear. I especially liked the "keybeep" feature. When you are entering data, a pleasant beep sounds every time you press a key. Experts have proven that this feature reduces the number of input errors.

There are numerous ways of storing files using the Commodore computers. It would seem that just about everyone has his own thoughts on what is the best way to do this. HAMLOG is the first program of this type that I have seen that uses relative disk files.

For those of you new to computing, Commodore allows you to create three kinds of disk files. The most common is the program file. It is exactly what it sounds like, though with some word processors, text is stored as a program file. In general, a program file is used to store a computer program.

The next type of commonly used file is called a sequential file. Generally, such a file consists of text or numbers. It could be a letter to Aunt Mary or a DXCC countries list. The information is stored in a sequential fashion, each character following the one in front of it. Searching sequential files can take forever.

Finally, there are random files and relative files. Both make searching the disk tor a particular piece of information much quicker. Relative files are structured into records. Within the records, the data is written into fields. This is the system used by HAMLOG. When using relative files, the programmer predetermines how large each record will be and how large each field will be within the record.

The versatility of such a filing system allows you to search by any of the fields within your log. You can select all the KH6 contacts for example, everyone named Jim, or perhaps all the contacts you made on your birthday. Such versatility can allow you to have "total recall" on the air so you can amaze all your friends!

How about other programs? How do they accomplish these things? Many of them, particularly programs designed for the 64, load all of the data into the internal memory of the computer. By doing this it isn't necessary to use the disk drive or tape cassette for anything but long-term storage. Particularly due to the relative slowness of the Commodore 1541 disk drive, this method can have its advantages.

One possible long-term negative effect of using the relative file method is that the disk drive stays active all the time you are searching or saving data. The 1541 is not the most durable piece of gear in the world. That's something you might want to consider when selecting your logging program.

Several features of HAMLOG deserve special mention. I liked the built-in QSL label generation routine. That will be a real advantage to the active contest operator or DXer.

Beam heading and actual distance information can be obtained for countries around the world.

Your log can be printed to a Commodore-compatible printer. In order for the printout to fit, you must use 9½-inch by 11-inch paper with the tractor-feed holes removed. I found that irritating since all of the paper I normally use is only 8½ inches wide.

The authors of HAMLOG spent a lot of time in creating a product that looks and operates well. I think a bit more explanation in the instructions of how the filing system works would be helpful, particularly to the novice user.

The instructions do not mention this, but it is possible to create your own data disks using one of several public-domain copy programs. You will want to do that before making entries or you will create a copy of an already full disk! It does take close to thirty minutes to create a data disk in this manner.

For more information, contact *HAMLOG, PO Box 308, Englewood OH 45322*.

Jim Grubbs K9EI
Springfield IL

WHAT DO *YOU* THINK?

Have you recently purchased a new product that has been reviewed in *73*? If you have, write and tell us what *you* think about it. *73* will publish your comments so you can share them with other hams, as part of our continuing effort to bring you the best in new product information and reviews. Send your thoughts to Review Editor, *73 Magazine*, Peterborough NH 03458.

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

I wonder how many of us got into RTTY as I did, with an overwhelming interest in tuning in to some of the RTTY news services. While I enjoyed my early ham RTTY experience, I know that what impressed the folks more than anything else was when I would tune in to this wire service or that bulletin and print out some current news item.

This came to mind the other day as I sat listening to the space shuttle in orbit. If you will pardon the tangent from RTTY, this is one aspect of our hobby that truly amazes me. Here in the Baltimore area we are blessed by being within VHF range of the Washington DC metropolitan area. As a service to the amateur-radio community, the Goddard Amateur Radio Club, located at the Goddard Space Flight Center in Greenbelt MD, retransmits shuttle communications for each flight.

You have no idea, if you have never done it, of the looks you can get by strolling through a store, hand-held on the hip, and having it blurt out, "Houston, this is *Discovery*!" I will say that it gives a new insight to the space missions, and I for one want to thank WA3NAN for the service. Although I can listen to the local link on 147.45 MHz, those of you not in the area can tune in as well on 3860, 7165, and 14,295 kHz. Transmission usually runs from launch to touchdown, so tune in to another goodie, only on amateur radio!

It's going to be hard to hide the schematic published this month (Fig. 1), so I guess I'd better get to that right now. I was strolling through my local Radio Shack the other day and I noticed a sale on a few chips of interest to RTTYers. This month, let's look at catalog number 276-2337, better known as an XR-2211 phase-locked-loop (PLL) demodulator. At five bucks (or less on sale) for the chip and a few dollars more for additional components, this certainly represents one of the most economical ways to get on RTTY.

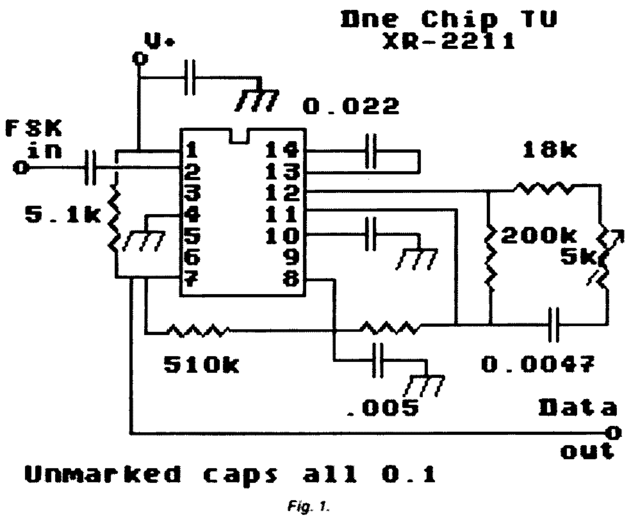


Fig. 1.

You can see that the audio signal from the receiver is coupled through a 0.1-uF capacitor to pin 2 of the XR-2211. The components shown in the schematic will set the PLL for the standard RTTY frequencies of 2025 Hz and 2225 Hz, and a 300-baud transmission rate. The center frequency of the PLL is determined by the 0.022-uF capacitor connected between pins 13 and 14 and by a 20k resistor formed by the combination of the 18k fixed and 5k variable resistors connected to pin 12. The bandwidth is defined by the 200k resistor bridging pins 12 and 11, and another filter is formed by the 0.005-uF capacitor and 100k resistor coming from pin 8. (The 100k resistor is not marked on the diagram.) This is only one scheme; additional information is packaged with the chip and is also available from any number of other sources.

In summary, this looks like today's version of a simple demodulator I built back in the late 1960s. That one used one tube and really did little more than detect and filter one of the two RTTY tones. I know it cost me more (in twenty-year-old dollars) than this one would cost and certainly did not perform as well. I hope this answers the question of where to find a simple starter TU.

Having said all that, I guess I would be remiss if I failed to acknowledge a rather

large packet of material received this month from Dan Szymanski K3SKE and Charles Miller K3ARN at Plantronics/Frederick Electronics Corporation in Frederick MD. They write, "After reading your 'RTTY Loop' column... I felt it is time you finally saw a good RTTY demodulator, not the computer interface PLL versions with no dynamic range or noise immunity to them." The material they sent along describes RTTY demodulators that would satisfy the most, and I mean the most, critical RTTYer. This is no surprise, as I have known of the excellent products produced by Frederick Electronics for many years. I would second the motion that, if you are looking for a professional quality unit (granted, at a professional price), you might drop them a note at 7630 Hayward Road, PO Box 502, Frederick MD 21701-0502. Be sure to drop our names in your note, okay?

Well, as I write this month's column I am still recovering from this year's giant Greater Baltimore Hamboree and Computerfest. Sponsored by the Baltimore Amateur Radio Club (which has had me as a member for too long to think about), this monster of an affair is traditionally held on the *rainiest* weekend in March. How they can predict the weather that far in the future is beyond me, but they haven't missed yet! Anyway, some photos of the goings-on are at the drugstore now, and if any of them are worth looking at, I will include them in the future. For the time being, let me just say that the proliferation of RTTY- and computer-related gear in our hobby continues to grow at an unprecedented rate. Everything from Model 15s to Model I's, on up to a packet-radio demonstration was there. Oh, before I forget, next year's 'fest is on April 6, 1986, moved a week later because of Easter. Maybe this will break the trend and be a sunny Sunday. See you there!

If I might get just a tad serious for a paragraph or so, I would like to address those of you who have felt a need to send certain other materials to me. Believe me, I am quite happy with my occupation, family, religion, where I live, and... well, you get the point. Please, please, try to contain your need to share what you may consider the good news, latest break, or whatever. I appreciate your mail, and look forward to deriving from it a sense for what you want to read about, but keep it at least somehow related to this column. Okay? Thanks.

Now, what I really have been enjoying are the varied, and I do mean varied, comments you all have been offering about the various RTTY programs for microcomputer systems. I really have received comments praising to the hilt the very same program that others of you would not touch with a ten-foot pole. I am taking some of your comments and forwarding them to the respective publishers for comments, with the submitting amateur's name deleted, of course. I hope that we will be able to get a handle on some of your complaints and perhaps glean a pearl or two of wisdom in the process. For those of you who have not yet acted, or who came in late, it's still not too late to send in information on the RTTY program you are using. We've run through all of the major microcomputer systems, so it's anybody's game now. Just tell me what system it's running on, the name of the program, the publisher would be nice, and any or all details you care to provide. What I especially am after is why you love it (if you do), hate it, or what you would like to see changed. Scribble it down on a postcard or QSL, save a few pennies postage, and send it to me at the above address.

Speaking of mail, those of you who have sent this or that note and enclosed a self-addressed, stamped envelope know that I do answer, albeit a tad slowly sometimes. Well, I think a new record has been set. A few of you have taken me up on the offer of reaching me through CompuServe and have received a reply within minutes of my receiving your E-Mail. Ah, the wonder of it all. If you want to take advantage of this communications marvel, I normally check the system every day or two and tend to hang around the CoCo SIG (GO COCO) or the Amateur Radio SIG (GO HOM-11). That all-important user number is 75036,2501. I will be looking for your comments.

Yes, there still are those of you who are asking about the summary of material from old columns. The list remains available at the above address for a self-addressed, stamped envelope. I try to update it every so often, so if you want the newest version, feel free to request it even if you have sent for one before. No problem.

I have a letter here from Leonard V. Sorg WØMNH, who has just gotten started in computers with a Tandy MC-10. This is the little wonder dubbed a "Micro-CoCo" when it was introduced, but instead of the 6809 CPU of the CoCo it uses a 6803, whose instruction set more closely resembles the 6800. At any rate, Leonard wants to put this computer onto RTTY and wonders how to do it. Well, I have seen nothing published on putting the MC-10 onto RTTY, and since Tandy has stopped making the thing, I suspect that we will see little more. I will nose around the SIG on CompuServe to see what turns up, but you may have to bite the bullet and try to convert some other program for your use. Leonard wants to try to do some of this in Basic, but I am afraid that interpreted Basic is just too slow for the task. I am sending that material which I have to him; stay tuned here for more, as it develops.

Another Motorola devotee is Lee Toman W3BIM in Quakertown PA. Lee is using a computer that runs a 6802 CPU and is interested in putting it on RTTY as well. Well, Lee, the 6800 code is directly translatable to 6802, as far as I know, so the elementary programs published here a few years back should serve you well. I am sending them along to you and hope you do well with the efforts. Be sure to let us all know, either with a note here or a call on the air.

Hey, Bud Johnson KA5UBH! I hope you can wade through the material I've sent you and that by now you have made some sense out of the Model 33 you have. As you may have realized, there is no "one standard" Model 33. Modifications were frequently done to adapt a particular unit to this or that service. I put the one I acquired in service after stripping it down and literally tracing the lines with an ohmmeter to figure them out. Book or no book, it's hard work. Perhaps someone in the Dallas area can touch bases with you, and with the materials I've sent you in hand and two (or more) heads butting together, you will get the thing working. Let me know what happens.

Looking in the hopper, I see plenty in the months ahead: photos from the hamfest, another circuit—this one for AFSK generation, some more letters, a rundown of the RTTY program hit parade, and all kinds of other goodies. Don't miss it—so many of you tell me that the first place you turn when you get your subscription issue is right here: "RTTY Loop."

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

CANADA DAY CONTEST
Starts: 0000 UTC July 1
Ends: 2400 UTC July 1

Sponsored by the Canadian Amateur Radio Federation (CARF), the contest is open to all amateurs and everybody works everybody. Entry classes include single-operator all bands, single-operator single band, and multi-operator all bands. There are also separate single-operator QRP (5-W output) classes for all bands and single band.

Use all bands from 160 to 2 meters on CW and phone combined. All contacts with amateur stations are valid. Stations may be worked twice on each band, once on CW and once on phone. No crossmode contacts and no CW contacts in the phone bands are allowed.

EXCHANGE:

Signal report, consecutive serial number starting with 001, and province. Do not use a separate series of numbers on each band.

SCORING:

Score 10 points for each contact with Canada, 4 points for contacts with others. VEØ counts as Canada and one multiplier. Score 20 bonus points for each contact with any CARF official station using the suffix TCA or VCA. That means an official station counts 10 points plus 20 bonus points for a total of 30 points!

Note that an added bonus of 50 points will be awarded this year to any amateur that provides communications for Parks Canada from a national park during the contest. A 50-point bonus will also be awarded to any amateur who uses the special prefixes for the National Parks Centennial during the contest.

Multipliers are the number of Canadian provinces/territories worked on each band, on each mode (13 provinces/territories × 8 bands × 2 modes for a maximum of 208 possible multipliers). Contacts with stations outside Canada count for points but not multipliers.

Provinces and territories are: VO1/VO2, VE1-NB, VE1-NS, VE1-PEI, VE2, VE3, VE4, VE5, VE6, VE7, VE8, VEØ, and VY1.

FREQUENCIES:

1810, 1840, 3525, 3770, 7025, 7070, 14025, 14150, 21025, 21250, 28025, 28500,

CALENDAR

Jul 1	CARF Canada Day Contest
Jul 13-14	IARU Radiosport Championship
Jul 20-22	CQ Worldwide VHF WPX Contest
Jul 27-29	County Hunters CW Contest
Aug 3-4	ARRL UHF Contest
Aug 17-18	New Jersey QSO Party
Aug 17-18	SARTG Worldwide RTTY Contest
Aug 19-25	Spec-Com North American UHF FSTV Contest
Sep 14-15	ARRL VHF QSO Party
Sep 14-16	Washington QSO Party
Sep 28-29	Late Summer QRP CW Activity Weekend
Oct 5-6	ARRL QSO Party—CW
Oct 12-13	Rio CW DX Contest
Oct 12-13	ARRL QSO Party—Phone
Oct 19-20	ARRL Simulated Emergency Test
Nov 2-3	ARRL Sweepstakes—CW
Nov 16-17	ARRL Sweepstakes—Phone
Dec 7-8	ARRL 160-Meter Contest
Dec 14-15	ARRL 10-Meter Contest

THE GROUNDWAVE

NEWSLETTER OF THE MONTH

July's winner, *The Groundwave*, comes to us from the Ottawa (Ontario) Amateur Radio Club (OARC). Gord VE3JMT, Ernie VE3ICP, Archie VE3NJY, and Kingsley VE3OFK pack as much information as possible into each monthly newsletter, including club news, regulatory actions, and feature articles on a variety of topics. A very important section acknowledges and welcomes visitors and new members of OARC, an item many clubs neglect.

We welcome *The Groundwave* to our list of award-winning publications, and congratulate the members of OARC on their superb effort.

To enter your club's newsletter in *73*'s Newsletter of the Month Contest, send it to *73*, 80 Pine Street, Peterborough NH 03458, Attn: Newsletter of the Month.

50.040, 50.110, 144.090, 146.52. Suggest phone on the even hours (UTC), CW on the odd hours (UTC). Since this is a Canadian-sponsored contest, remember to stay within the legal frequencies for your country!

AWARDS:

Certificates will be awarded to the highest scorer in each category in each province/territory, US call area, and DX country. If scores are close, second- and third-place certificates will be awarded. Additionally, several trophies will be awarded to some top scorers, courtesy of sponsors.

ENTRIES:

A valid entry must contain log sheets, dupe sheets, a cover sheet showing claimed QSOs, QSO points, a list of multipliers, and a calculation of final claimed score. Cover sheets and multiplier checklists are available. Entries should be mailed within one month of the contest, with your comments to: CARF Contest, c/o N. Waaltho VE6VW, Box 1890, Morinville, Alberta, Canada T0G 1P0.

Results will be published in *TCA*, the Canadian amateur magazine. Nonsubscribers may include an SASE for a copy of the results.

IARU RADIOSPORT CHAMPIONSHIP
Starts: 0000 UTC July 13
Ends: 2400 UTC July 14

Note that these rules are from last year's contests as updated rules were not available in time for this column. Check the appropriate issue of *QST* for any last-minute changes.

This contest is open to all licensed amateurs worldwide. The object is to contact as many other amateurs in as many parts of the world as possible using 1.8 through 148 MHz. Single-operator stations must not operate more than 36 hours of the contest period. Operating categories include:

A) Single operator: phone-only, CW-only, and mixed-mode sections. One person performs all operating and logging functions. Use of spotting nets is prohibited. Off times must be 30 minutes minimum and single-operator stations are allowed only one transmitted signal at any given time.

B) Multi-operator: single transmitter, mixed mode only. Only one transmitted signal allowed at any given time and must remain on a band at least 10 minutes at a time. All operators must observe the limits of their operator's license at all times. Stations may be worked once per frequency band, crossmode, crossband, and repeater QSOs do not count.

EXCHANGE:

Signal report and ITU zone.

SCORING:

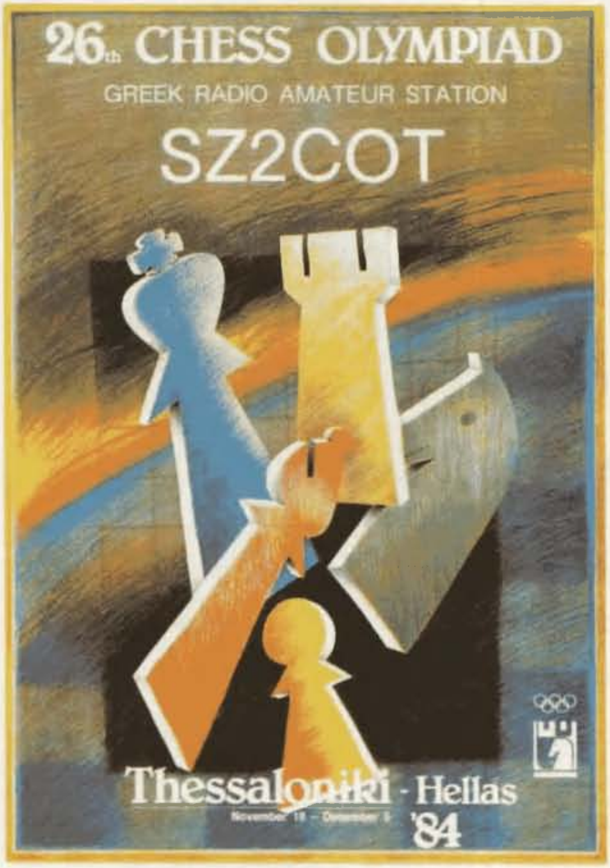
Count 1 point per QSO within your ITU zone, 3 points within your continent but different ITU zone, and five points with different continents. Multipliers are the number of ITU zones worked on each band. Final score is total number of QSO points multiplied by the sum of ITU zones worked on each band.

ENTRIES:

All entrants are encouraged to use forms available from IARU/ARRL headquarters. Send SASE or 1 IRC. Logs must indicate times in UTC, bands, calls, and complete exchange. Multipliers and off times should be clearly marked in the logs. Cross-check sheets are required if more than 500 QSOs total are made. Entries must be postmarked by mid-August; any entry received after mid-October may not be in time to be included in the printed results. Usual conditions of entry and disqualification apply. Entries should be addressed to ARRL, 225 Main Street, Newington CT 06111.

AWARDS:

A certificate will be awarded to the high-scoring CW-only, phone-only, mixed-mode, and multi-operator entrant in each ARRL section, each ITU zone, and each DXCC country. In addition, achievement-level awards will be issued to those making at least 250 QSOs or having a multiplier total of 50 or more. Additional awards may be made at the discretion of each country's IARU society.



QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, 80 Pine Street, Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

CQ WORLDWIDE VHF WPX CONTEST
Starts: 0000 UTC July 20
Ends: 0000 UTC July 22

This is a brand-new event sponsored by *CQ* magazine but SCORE, the Society of Contest Operators and Radio Experimenters, of Denville NJ, is the administrative head of the contest committee. This contest is an international VHF/UHF competition where multipliers are prefixes and there are eight different levels of competition in each geographic area.

Details on SCORE and the contest ideas were presented in the February '85 issue of *CQ*, with possible updates to follow. Be sure to check *CQ* for any last-minute changes. If all goes well, the event is planned to be an annual event! Anyone interested in sponsoring awards can contact SCORE or *CQ* at the addresses listed below.

Classes of entry include: single-operator, single-band; single-operator, multiband, single-operator, single-band, low-power, single-operator, multiband, low power; multi-operator, single-band; multi-operator, multiband, portable (with temporary power source), and FM-only. Low power is defined as 25 Watts PEP output or less.

Use all authorized amateur bands and frequencies from 6 meters through 23 cm (50, 70, 144, 220, 432, and 1296 MHz). All authorized modes are allowed for contest credit, with the single exception that repeater contacts cannot be allowed or counted for contest credit. Satellites are considered repeaters!

EXCHANGE:

Consecutive serial number and callsign.

SCORING:

Multipliers are prefixes worked per band. Score 1 point per QSO on 50, 70, or 144 MHz, 2 points per QSO on 220 and 432 MHz, 4 points per QSO on 1296 MHz. Work stations once per band, regardless of mode. Multiply total QSO points times total number of prefixes worked (the sum of the prefixes worked per band).

AWARDS:

For first-year participants, a commemorative certificate will be issued to *every* entrant to celebrate the first annual VHF WPX. Trophies to national top-scoring stations in each category. Certificates to top-scoring stations in each call area or country where special effort is demonstrated.

ENTRIES:

Contest entries should be mailed to SCORE, PO Box 1161, Denville NJ 07834, or to *CQ*, 76 North Broadway, Hicksville NY 11801.

CW COUNTY HUNTERS CONTEST
Starts: 0000 UTC July 27
Ends: 0200 UTC July 29

The CW County Hunters Net invites all amateurs to participate in this year's contest. All mobile and portable operation in less active counties is welcomed and encouraged. Stations may be worked once on each band, and again if the station has changed counties. Portable or mobile stations changing counties during the contest may repeat contacts for QSO points.

EXCHANGE:

QSO number, category (P for portable, M for mobile), RST, state/province/country, and US county. Stations on county lines give and receive only one QSO number, but each county is valid for a multiplier for the receiving station.

FREQUENCIES:

3575, 7055, 14065, 21065, 28065. On 20 and 40 meters, mobile and portable stations should call CQ or QRZ below the suggested frequencies. Fixed stations CQ or QRZ above the suggested frequencies.

SCORING:

QSOs with fixed stations are 1 point. QSOs with portable or mobile stations are 3 points. Multiply the sum of all QSO points times the number of US counties worked. Independent cities may be counted as any one of their adjoining counties in accordance with USACA rules. Mobiles and portables calculate their score on the basis of total contacts within a state for the state certificate and calculate their score on all operation if they operated from more than one state in competition for the High Portable or High Mobile Trophy.

AWARDS:

Certificates will be awarded in three categories:

P) Highest station in each state operating portable from a county which is not its normal point of operation, when total score exceeds 1,000 points.

F) Highest fixed or fixed-portable station in each state, province, and country when total score exceeds 1,000 points.

M) Highest station in each state operating mobile from 3 or more counties with a minimum of 10 QSOs in at least each of 3 counties.

Plaques will be awarded to the highest mobile, portable, and fixed stations in the USA who meet the above requirements for certificates. Additional awards will be issued where deemed appropriate.

ENTRIES:

Logs must show category, date/time in UTC, station worked, band, exchanges, QSO points, location, and claimed score. All entries with 100 or more QSOs *must include a check sheet of counties worked or be disqualified from receiving awards*. Enclose a large SASE if results are desired. Logs must be postmarked by September and sent to: CW County Hunters Net, c/o Jerry Burkhead N6QA, 7525 Baltic St., San Diego CA 92111.

LETTERS

HAM HIGH

I was impressed and pleased with the survey results in your May, 1985, issue. Allow me to add my voice to those in the amateur community who feel very positive about amateur radio.

I was licensed on May 29, 1985, through a Novice class at a local Civil Emergency Preparedness office. The instructors guided our class through elements 1(A), 2, and the code with endless patience and understanding. I owe both K1YNO and KA1FTL my thanks and respect.

An aspect of amateur radio not covered in depth in *The ARRL Handbook* that is extremely important is the special sense of belonging that erases barriers, makes instant friends of strangers, and broadens our understanding and enthusiasm for life.

As a new amateur still in the process of building a transceiver, I haven't had the pleasure of a QSO on the air. But I felt that sense of belonging in a special way during a visit with KA1HWY. I stopped at his house after noticing the antenna farm in the side yard. He and his wife had just returned from Florida and were very busy with unpacking. Although they had never met me, when I told them I was a Novice they welcomed me into their home. I spent an hour looking at equipment, listening to a QSO, and talking about antennas. KA1HWY told me he would be looking for me on the air and to keep in touch. I came away with a tremendous sense of pride for the Amateur Radio Service.

I know there are those who don't look at amateur radio as I do, but I feel they are selling themselves *and* the service short. It demands the best from each one of us and perhaps this is its greatest treasure.

Thanks for a great magazine!

Duncan (Scott) Cameron WA1MUY
Pemaquid ME

MISUSE AND ABUSE

I have a subject that I think should be brought up, and that is the misuse and abuse of the 10-meter band. I've only been licensed about 6 months, but I have noticed a dramatic increase in the number of intruders on this band. The intruders that I have noticed popping up seem to be car services and CBers.

I thought that 10 meters was allocated just to hams, not unlicensed persons! Even though I'm new, I have only come across a few other amateurs that care enough to monitor and take notes of such activity. It aggravates me even more when contests are going on and no one can copy anything! Has anyone else thought of taking action against these intruders? I guess not, or I would have read or heard something on the matter. Why do I sense that everyone is ignoring 10 meters? Even if the propagation isn't great most of the time, it's still a band that is allocated to us amateurs.

Let's all pay more attention to what goes on when this band isn't active. You will be very surprised at what goes on there! Let's not sit around and watch 10 meters turn into another Citizens Band. Remember, we might have to go through what we had to do to keep the 220-MHz band. I hope some of you give this some thought.

Billy Oggeri KA2VXY/AG
Queens NY

NEW BLOOD

As a relatively new subscriber to *73*, I guess it's time I sat down and said how much I enjoy the magazine. In a time when most hams, it seems, would rather buy the latest state-of-the-art equipment, it is great to see *73* packed with so many "how-to" ideas every month. This is the reason I buy *73*.

Looking back through my collection of magazines (dating back to the late forties) you can see ham radio drift slowly from the days when stations were either homebrew or at least kits, to the present, when it seems so many hams can't even solder properly. With articles in *73* on how to build your own RTTY and SSTV interfaces, I hope to see this trend reversed. With today's children being computer-literate in grade school, this may be one way that we can attract new blood into what would appear to be a dying breed.

Garth Carman
Edmonton, Alberta
Canada

ISHMOD EXPLAINED

Re: "Ishmod's Journal"

OK, you did it again, didn't you? Two times in a row? Come on, now! I am dying of curiosity—what in heck did ever happen to those guys? Do you ever think we will find out?

Patrick Chirington
Lakewood OH

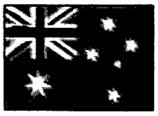
Patrick—Spenser Whipple, Jr. was unfortunately out of town when we last called, but we do have a letter from him regarding Ishmod and the journal. Actually, we have half of the letter. The other half has mysteriously vanished. Spenser claims that he has discovered the

Continued on page 226

73 INTERNATIONAL

Each month, 73 brings you ham-radio news from around the world. In this collection of reports from our foreign correspondents, we present the latest news in DX, contests, and events, as well as keep you abreast of the technical achievements of hams in other countries.

If you would like to contribute to your country's column, write to your country's correspondent or to 73 Magazine, Pine Street, Peterborough NH 03458, USA, Attn: Perry Donham KW1O.



AUSTRALIA

J. E. Joyce VK3YJ
44 Wren Street
Alton 3018
Victoria
Australia

Kirsti Jenkins-Smith VK9NL
PO Box 90
Norfolk Island
Australia, 2899

AMATEUR RADIO AN OFFSHOOT OF CB

This appears to be the belief at our local library. I recently decided to rejoin the library, with the view that I would be able to get background information for the columns for "73 International."

Deciding to look up amateur radio, I found that the index card stated: "Amateur Radio—see Citizens Band Radio." "What?!" said I, in a voice loud enough to cause the lady librarian to leave her desk to ask, "May I help you Sir?" with the emphasis on "Sir"!!

After explaining my requirements, I got a quick now-you-see-it, now-you-don't tour of the electronics section. We don't exactly live out in the sticks, being only 8 miles from the center of Melbourne, with a well-appointed library that is supposed to be representative of modern trends—with computers for general use, etc., but even the computer file of amateur radio referred you back to Citizens Band Radio.

Vowing to come back when my embarrassment subsided, I bid her good-bye and retreated from the library with my tail between my legs—as the saying goes.

Gathering up enough courage, I again visited the local library the next weekend to find out what was available with regard to amateur radio. The following list proved somewhat of a letdown to me:

Modern Radio Servicing—Chirardi (1935)
Practical Communications—Nilson (1943)
Radio Engineering—Sandeman (1949)
Wireless for Beginners—Boltz (1964)
Teach Yourself Radio—Gibson (1968)
VHF Projects for Amateur & Experimenter—Wayne Green (1972)
Radio Amateurs' Handbook—1982 Edition.

As you can see by the above list, there's not much help to the budding amateur, apart from the latter couple of books.

There were quite a few books on servicing and operating procedure on CB, but the main information was of pre-1970 vintage, showing the lack of promotion we in the amateur service give in our local area.

I wonder what your local library has in the way of information on amateur radio?

STOLEN EQUIPMENT

There has been, of late, an upsurge in the theft of amateur gear in VK, with some amateurs getting their whole shack cleaned out. One of the unlucky losses I have heard about was by the chap who, having saved up for 18 months to buy a new transceiver, traveled down from the country to the city to buy an FT-101ZD at a discounted price.

After buying the set and placing it in his car, he decided to buy a packet of cigarettes from the shop next door. Only going to be away 2 minutes at the most, he failed to lock the car. You guessed it; no rig on his return. When last heard, he was having "in depth discussions" with his insurance company, re a replacement.

To try to alleviate the problem of tracing stolen equipment, the Federal Branch of the WIA has now started keeping a list of all amateur-radio gear stolen, Australia-wide, with the view that there might be some organized interstate trafficking in stolen equipment. This centralized listing also will make it easier to trace the original owners. The WIA's nationally-distributed magazine, *Amateur Radio*, is also going to publish a monthly list of all amateur gear stolen, with serial number listings and easily-distinguishable markings.

THIRD-PARTY TRAFFIC

Third-party traffic agreements are being finalized by the Department of Communications with Venezuela, Honduras, and Liberia. This will bring to five the number of countries with which Australian radio amateurs can directly exchange third-party messages. America and Canada were the first to reach third-party agreements with Australia.

Following requests from the WIA, further negotiations are continuing with another 30 countries to obtain further such agreements.

AUSTRALIAN TRAFFIC NETWORK

International third-party traffic exchanges between ATN and the National Traffic System of the US and Canada have taken place over the International Assistance and Traffic Network at 1130 UTC on 14.303 MHz daily, over the four-year period, 1981-1984. Due to poor propagation over a three-month period, two new networks are now carrying this traffic—effective January of this year.

The International Morse-code section of the ATN is daily at 0700 UTC on 7.037 MHz ± QRM; the international phone section of the ATN is daily except Sundays, 0800 UTC between 7.225 and 7.300 MHz.

Several operators in Canada and the US pass traffic using RTTY, AMTOR, FEC, or packet. If you wish more information, check into the national phone section of the ATN daily at 1030 UTC, 3.570 MHz ± QRM.

VK9X—CHRISTMAS ISLAND INFO

Many people keep asking on air if there is any activity from VK9X. Well, as of this writing there are five amateurs on the island. They are Craig VK9XW, Ron VK9XA, Charles VK9AB (limited license, meaning 6 meters and above), Dane VK9XD, and Ron VK9XJ. There also has been Lance VK9XG checking into the 14.220 net at 0600 UTC on odd occasions. Steve VK9XB had a two-week DXpedition to Christmas Island during late March/early April. His QSL info is via home call VK6IR.

Although the signals are down at the present time due to poor antenna systems and band conditions, the near future should see better antennas erected and more operations from this much-wanted DX location.

de VK3YJ

NORFOLK ISLAND

Norfolk Island has been variously described as "only fit for angels and eagles," "a thousand miles from nowhere," and similar terms to indicate its isolation and inaccessibility.

All this was true in the old days—also referred to as the "days of blood." Norfolk Island was then a maximum security penal colony. The prisoners being held here were those considered too dangerous, too unruly, too villainous to be held in mainland Australia. This was the end of the line, one step away from the gallows. From here there was no escape.

This era of Norfolk Island's history is full of tales of mutiny, revolt, murder, revenge, executions, lashings, and curses. Especially the curses. On the south side of the island lies Kingston, with the prison ruins and officers' quarters, military barracks and stores still lining the road now known as Quality Row. Even today what is left of the prison compounds mutely echos the depraved officers' shouts and the prisoners' cries and curses.

Some of the buildings from this era are still in use. The Commissariat's Store has become All Saints Church and the Military Barracks house the Administration offices. Several of the officers' quarters are now in use as private homes.

Kingston abounds with ghost stories. People who value their sanity do not, for instance, work overtime in the Administration offices. White faces have been "seen" staring out of windows on many occasions. There is the sound of footsteps, a chair creaks as if someone just sat down, doors quietly open and shut... there is the creeping sensation of the unknown watching you.

This part of the island has not changed over the years. No shops or other commercial development has been allowed. The area is a big outdoor museum with authentic atmosphere among the stone walls. We walk on convict-built roads, sit on the convict-built seawall looking out over the endless blue empty ocean where only the surf breaking on the coral reef relieves the monotony.

Ships seldom lay their courses close to Norfolk Island. In that respect, it is still too far away from anywhere. But a small freighter calls in every six weeks or so, bringing supplies. The island has no harbor, so the freighter lies at anchor and is unloaded by lighters. Time is of the essence when "the ship's in." If the seas become rough, unloading has to be abandoned.

Such was the only communication Norfolk Island enjoyed with the outside world until 1902 when the Pacific Cable Board's station was opened. Norfolk became an important link in the Pacific cable system. From Vancouver, the cable came via Fanning Island and Fiji to Norfolk where it divided, one arm extending to Queensland, Australia, and the other to Auckland, New Zealand. The island thus had a telegraph link to the outside world.

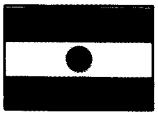
With modern technology came the closing of this station, at the end of 1962, to be replaced by a radio link. To begin with, this also was strictly for telegrams, but as time went on the radio link developed to serve overseas telephone calls as well—more often matters of sheer frustration than anything else.

Angels and eagles had become a thing of the past. The airstrip built during World War II effectively opened up Norfolk Island to more earthbound creatures like tourists and new settlers. With the influx of people from 1960s and onwards, proper communication facilities became an important issue. But it was not until 1984 that things changed for the better. The huge ANZCAN cable now connecting Australia, New Zealand, and Canada also takes in Norfolk Island. The "cable station" is again a reality.

We now enjoy direct-dialing overseas telephone, telex, and facsimile facilities. This year could see the introduction of satellite TV. Plans for a satellite which has Norfolk Island in its footprint are set down for August.

And while all this 1985 technology and tourist-related hustle and bustle takes place in the interior of the island, Kingston rests calmly, a solemn monument to Norfolk Island's "days of blood," enveloped in a mist of salty spray blowing inshore from the breaking surf.

de VK9NL



INDIA

Miss R. Subha
3 Thiru-Vi-Ka Road
Post Box 725
Madras 600 006
India

The import of several hundred Yaesu, Kenwood, and ICOM hand-helds into this country has highlighted the need for repeaters in the large cities—Bombay, New Delhi, Madras, and Calcutta—where the concrete jungle reduces the range of the hand-helds to less than a mile. Most of these hand-helds are either hibernating or are being used as base stations with rooftop ground-plane antennas. Some are used in automobile, bicycle, and walking mobile modes.

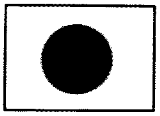
The owners of these hand-helds now see clearly the need for a repeater on one of the tall buildings. Tall buildings are aplenty—but where are the repeaters? Most of the local societies have discussed this issue at length and members have pledged the equivalent of ten to twenty dollars (US) each for the purchase of a repeater, but the discussions have always ended upon how to get an affordable repeater.

There is one logical source for Indian hams: Look to the West for the gold mine of used and retired repeaters. The move towards microprocessor-controlled repeaters in the US obviously results in a number of old, simple, common-access repeaters being retired. What happens to these repeaters? We asked a number of visiting US hams, most recently, Bill Eccles KE4VT, and the answer was always, "I have to ask my local repeater group."

We now bring this question direct to the readers of *73*. If you have a used 2-meter repeater to give away or to sell, please consider offering it to The Federation of Amateur Radio Societies of India, 3 Thiru-Vi-Ka Road, Post Box 725, Madras 600 006, India. The FARSI President, M. V. Chauhan VU2MV, will coordinate the import

and deployment of any repeaters that may be offered.

If you are responding, please send brief specs and mention the price. The buyer will have to apply to the government of India for a waiver of customs duty based upon this offer. Please be clear about what is included—especially the duplexer. If it can be shipped by surface mail, will you please include an estimate of the mailing costs? An estimate of the air freight may be included as an option. Thank you!



JAPAN

Roy Waite W9PQN
Tomigaya Grand-301, 2-19-5 Tomigaye
Shibuya-Ku
Tokyo 151
Japan

VISITING JAPAN?

If you are a ham and are contemplating a visit to Japan, there is a ham-radio club that you should know about. It is called TIARA, or Tokyo International Amateur Radio Association. We meet on the last Friday of each month at St. Alban's Church here in Tokyo. Let me tell you briefly about TIARA, what we do, have done, and hope to do in the future.

TIARA was founded in June, 1971, by two English and two American hams; I was one of the Americans. Prior to that time, the only foreign-affiliated amateur-radio club in Japan (to my knowledge) was FEARL, or Far East Amateur Radio League, which is a military-affiliated organization. Nothing wrong with that, of course, but we non-military types living in Tokyo do not have easy access to the military bases, which are located at some distance outside of town. In any event, we put our ham heads together and decided to form a club for foreigners, by foreigners, of foreigners. (Not an original thought by any means.)

But what about the Japanese hams? The pros and cons of that were kicked around. One man worried that since the ham population in Tokyo is so huge we'd soon be overrun if we opened our doors to Japanese hams, and the club would lose its "foreign" flavor; we would have defeated the original purpose. Others reasoned that ham radio is not an exclusive fraternity and its true spirit is best expressed by borrowing a cliche: everyone, regardless of race, nationality, color, sex, creed...!

So we began on that note, and in fact were not overrun by Japanese hams; instead, we found many new fine Japanese friends, many of whom are still staunch TIARA members to this day. Of course, we found the other kind, too, including some Americans whom we felt were so obnoxious that we swiftly announced that our membership rolls were temporarily closed when they approached us to join. (Forgive us, Lord!)

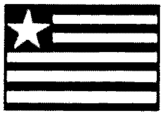
At present, the president of TIARA is Joe Speroni AH0A/JH1ZDJ. Under Joe's guidance, TIARA has greatly expanded the number of members, installed a repeater station in one of the highest spots in Tokyo, and has done a lot of work with the Japanese Ministry of Telecommunications and Post to help get the reciprocal agreement put into effect (which, so far, has not been completed).

Some of our accomplishments:

- We helped get a group of young men on the air from a hospital for muscular dystrophy patients, arranging for manufacturers to donate equipment, and helping to put the antennas up.
- We helped get the Maryknoll Sisters on the air, as well.
- Bill Stenson NA2Y/JR1YGP, one of our vice-presidents, established a non-profit-making school for budding hams, and has graduated many, many new hams and brought them into our ranks.
- We publish a monthly newsletter called simply *TIARA Bulletin*, edited by Ms. Pat Degeest NJ7R.
- We have an annual Field Day here on the first weekend in August.
- Last year we had our own booth at the Hamfest (a mini-Dayton Hamfest) in August, and are planning the same this year.

For the future, we are looking forward to reciprocal operation instead of club-station operation as we have at present. Also planned are bigger and better Field Days.

If you're going to be in Tokyo either as a resident or traveler, drop us a line at TIARA, PO Box 119, Akasaka, Tokyo 107-91, Japan. Or, after you get here, call our secretary, Keith Wilkinson ZL2BJR, whose telephone number is 0462-28-5367. We'd be delighted to have you join us either as a new member or as a visitor.



LIBERIA

Brother Donard Steffas, C.S.C.
EL2AL/WB8HFY
Brothers of the Holy Cross
St. Patrick High School
PO Box 1005
Monrovia
Republic of Liberia

AMATEUR RADIO IN LIBERIA

Liberia has a new repeater!

Getting a new repeater would not make headlines in many countries but it is real headline news here. For years, and it is probably more than a dozen, there has been one repeater in Liberia. It boasts of a tower on top of a mountain which rises majestically to a height of at least twelve hundred feet. It was set up and maintained by a small group of German amateurs who found themselves on the staff of the Bong Mines Iron Ore Company. The company was named after Bong County, Liberia, in which it is located.

The Bong Mines area is located some forty miles out of Monrovia. With reasonable equipment and a good antenna, the repeater serves the Monrovia community very well, and with better equipment it can reach some of the outlying areas. Dr. Munson EL5G, who has written for this column on at least two occasions, was able to access the Bong Mines repeater from a distance of more than a hundred miles. He built a 14-element yagi and drove it at about forty Watts. On good days, Dr. Munson was able to communicate with Monrovia Q5 from his QTH almost at the border of Sierra Leone.

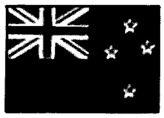
In 1977, Walcott Benjamin EL2BA, who was president of the Liberia Radio Amateur Association at the time, went to a meeting of the International Amateur Radio Union. He went as a representative of the local association. In his conversations with the delegates from the German Amateur Radio Society, he suggested that they consider the possibility of contributing a two-meter repeater to Liberia. Correspondence has been carried on during these intervening years. There were many difficulties to be worked out, but the effort went on on both sides and now, in 1985, we have the repeater. It is new. It is installed. And...it works.

At the present time the arrangement is temporary. It has an excellent location and a very good antenna. It responds to a one-Watt HT from anywhere in the greater-Monrovia area. It is battery powered with a voltage-controlled charger keeping the batteries at full charge. The location will not be changed but it will have to be given a new frequency.

The plan is to make this repeater "talk" to the Bong Mines repeater and in turn to make it "listen" to the Bong Mines repeater and then tell us what it is saying. Fortunately, we have a number of amateurs in our association who are able to handle technical problems of this nature. Fortunately, also, we have another little repeater, about ten Watts, which can be used as a link between the other two.

The Monrovia repeater will transmit at 145.050 and receive at 145.650. It will be connected by wire to the little repeater which will transmit to Bong Mines at 145.100 and receive signals from there at 145.700, which will then be transmitted to the Monrovia area at 145.050. In the meantime, the Bong Mines repeater operates as it always has, receiving at 145.100 and transmitting at 145.700. When all this is working according to the projected plan, we will have HT communication all over this part of Liberia.

The situation in Liberia is somewhat unique. We really need to have everyone on the same repeater in order to achieve the kind of communication that we need. We never have the problem of the repeater being crowded. In the past, it has been next to impossible to contact anyone during the working day, and even at other times one could not contact another amateur unless the other person happened to be at home. With this new HT capability it will be a simple matter to carry the little radio along and be available at the other times during the day.



NEW ZEALAND

D. J. (Des) Chapman ZL2VR
459 Kennedy Road
Napier
New Zealand

I have been reading with interest through *73* editorials and columns about the issues on the "no-code license" proposals and their subsequent demise on ARRL's recommendation. It causes me and other ZLs to chuckle! Here in ZL-land we have had a no code license since 1962. In fact, soon some of the original "T" call hams (as we colloquially term our Grade III amateurs because originally their callsigns were prefixed by the letter "T" after the District ID, e.g., ZL2TDB) will become eligible for membership in the Old Timers Club (25 years an amateur). A proportion of these Grade III amateurs are interested only in VHF/UHF/SHF experimentation, development, and operation. They have no desire to progress to the higher grades of license. There are also some who don't wish to learn Morse code, a requirement to progress to the higher grades of license.

To obtain an Amateur Operators Certificate, Grade III (no code), the candidate is required to pass an examination containing written papers on the elementary principles of electricity, radio communication techniques, the adjustment of a typical amateur station, and the Radio Regulations as they are applicable to the Amateur Service. The Grade III license entitles the amateur to operate 27.12 MHz, 51.00–53.00 MHz, and all bands 144 MHz and above.

To progress in the hobby, the amateur must pass a Morse-code test, sending and receiving at twelve words per minute for three minutes. A pass in this test entitles the amateur to the Grade II certificate, and operation on these additional bands: 1800–1950 kHz, 3500–3900 kHz, 28.0–29.7 MHz, and 50.00–50.15 MHz.

To obtain a Grade I license, the Grade II amateur must have operated for at least one year in that grade and had not less than 50 contacts on frequencies below 50 MHz. In addition to this qualification, the amateur must show by a further Morse test that he/she is still able to send and receive at 12 wpm.

The no-code license in New Zealand has not had any detrimental effect on the hobby; in fact, in the 22 years we have had the Grade III licenses, the numbers have grown to include some very dedicated and technically-proficient VHF/UHF/SHF members who are the leaders in the ZL VHF, etc., developments, as the next paragraph indicates. So go to it, amateurs in the US, support Wayne and the others who have plugged for the no-code license; it is a way of harmlessly introducing more to the hobby.

THE AUCKLAND-WELLINGTON LINK SYSTEM

For the past two years, interested amateurs have been investigating the possibility of a VHF/UHF link system between the two main cities of the North Island of ZL, Auckland and Wellington, a distance of about 500 km, line of sight. The system will be introduced very soon. The link will consist of UHF broadband system with an intermediate repeater site at about the halfway point sited on Mt. Egmont on the west coast of North Island. The link will provide up to twelve 3.4-kHz-wide voice-frequency channels for use as simplex and repeater links, initially between Auckland and Wellington but later to be extended as the need arises to other North Island areas and South Island.

Why do we in ZL want the system? The reason for, and the uses to which it may ultimately be put, are many. The technical challenge presented by the concept of repeater linking is exciting, and will extend the knowledge and expertise of those involved. As the link expands, then too will other NZART branches involve interested technicians to extend their expertise and knowledge accordingly.

The applications are many. The first phase of the system will see two UHF repeaters, one in Auckland and one in Wellington, linked on a permanent basis. This first application will, it is hoped, stimulate further interest in UHF generally and increase the activity on the 70-cm band. Extensions of the link to other UHF repeaters could see a network of linked UHF repeaters around the country, providing reliable 24-hour communications. This has obvious applications for AREC (Radio Emergency Communications) and Civil Defense emergency communication as a supplement to the existing HF links. If the level of activity increases as a result of this facility, a more complex linking/switching system may have to be introduced.

Other applications include a monthly Official Broadcast, special applications such as packet radio, HF DX information, AMSAT information, and a host of others, provided one has the time to look for them. The interest in AMSAT has in-

George England ZL2LT in his wheelchair, shortly before his death.

creased to the point where a weekly AMSAT news and net is necessary to keep the growing number of amateur satellite users suitably informed

In order to cater to the interests of those amateurs who will never want to operate on the bands above 2m, an addition already planned is a scanning-type transceiver at both ends of the link, with one channel being used to tie the two transceivers together. Normal operation of the transceivers would be in the scan mode, listening to all the local 2m repeaters in range of the site. To use the link, an amateur would generate a specific tone sequence either on a frequency directly into the scanning transceiver or via his local repeater, the output of which would be heard by the scanner.

This would be recognized by the scanning receiver as an access code and it would respond with a short tone burst in acknowledgement. On receipt of the acknowledge tone, the amateur could then transmit a further series of command tones which would be passed along the link to the scanning transceiver at the other end. These tones would cause the scanning transceiver to switch to the remote repeater selected so the originating amateur could hold a QSO of say three

L to R, Jos ZL2BAO, Jack Carrell ZL2AWZ, Flo KU7F, and Irv KU7E—when Flo and Irv were visiting Jack in February, 1984.

minutes duration after which the link would time out, releasing the equipment. The Wellington-Mt. Egmont link will be 1259.15 MHz/1299.15 MHz and the Mt. Egmont-Auckland link, 1259.5MHz/1299.5 MHz, both ends being accessed on 70 cm.

SILENT KEYS

Recently, two very well known amateurs from your correspondent's area joined the ranks of the Silent Keys, and as they both were well known on the amateur bands in ZL and overseas, I felt each warranted a paragraph or two in this column.

Jack Carrell ZL2AWZ became a Silent Key in January this year. Jack was known to his many amateur friends overseas for his willingness to help where needed and his hospitality; he hosted many overseas amateur visitors from W, VE, VK, JA, and many other countries in his home at Hastings. (See photo.)

Jack was for many years one of the main MCs of the New Zealand County Hunters Net held daily on the HF frequencies, and was instrumental in obtaining their NZ Counties Award for many overseas amateurs. First licensed in October, 1957, as ZL2AWZ, Jack obtained his high-frequency permit in March, 1959. He was associated with the Scout movement as a JOTA station on many occasions, and was a member of the Masonic lodge. He was awarded a plaque by the County Hunters in 1982 in recognition of his services to the county hunters of North America. Jack's son, Mark, a recent visitor to California after attending the Police Olympics, hopes to sit and pass the amateur examination this year and then to apply for his late father's callsign.

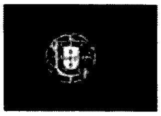
George England ZL2LT, better known as 2 London Tokyo, aged 36 years, also became a Silent Key in January this year (see photo). George was probably one of the most physically-handicapped amateurs in the world. He suffered from muscular dystrophy from birth which got progressively worse as he matured. He was completely paralyzed from the shoulders down, being able only to move his head. He was confined to a wheelchair, and since 1972 was a resident at the Pukeora Home for the disabled at Waipukurau.

George was licensed by special permit for RT only as a Grade II operator in June, 1966, and was granted HF privileges in 1968. He operated his wheelchair, amateur rigs, and an electric typewriter with a stick attached to a headband centered on his forehead. He kept his log on the electric typewriter, in duplicate, on teleprinter paper; one copy he kept, the other was sent to his mother and QSL Manager, Vi ZL2BGK. He was an intelligent, witty ham, who liked the ladies, his beer, and amateur radio. He had a phenomenal memory and a great sense of humor, and was always ready to pass a QTC for anyone at anytime. His voice will be sadly missed from the HF and VHF bands. George would be well known to many overseas amateurs, as he was very active on the HF bands from 1968 to 1972 when he lived in Wellington, and since 1972 when he moved to Waipukurau.

TIDBIT

Have you ever traveled 10,000 miles to attend a Field Day Contest? Don Fisher VE3ESE/ZL0AHH from Toronto, Ontario, Canada did just that in February this year. Don was vacationing in New Zealand with his wife, and he arranged his itinerary so that he was visiting Lee ZL2AL in Hastings over the weekend that the ZL Field Day Contest was held. Don joined the Napier Branch team on the banks of the Tutaekuri River and, in his words "had a ball." He helped the Branch 25 team to victory in the ZL2 District contest, and they expect to be about 3rd overall in ZL. After the Field Day weekend was over, Don and his wife continued their camper-van holiday towards Auckland and his departure home to Toronto.

Don is involved in Field Day organizing in his home QTH, so his help was invaluable during the weekend. He had his wife take a photo of the Branch toilet (*mercifully not shown—Eds.*) to show his Toronto ham friends how ZL Field Days provide "home comfort."

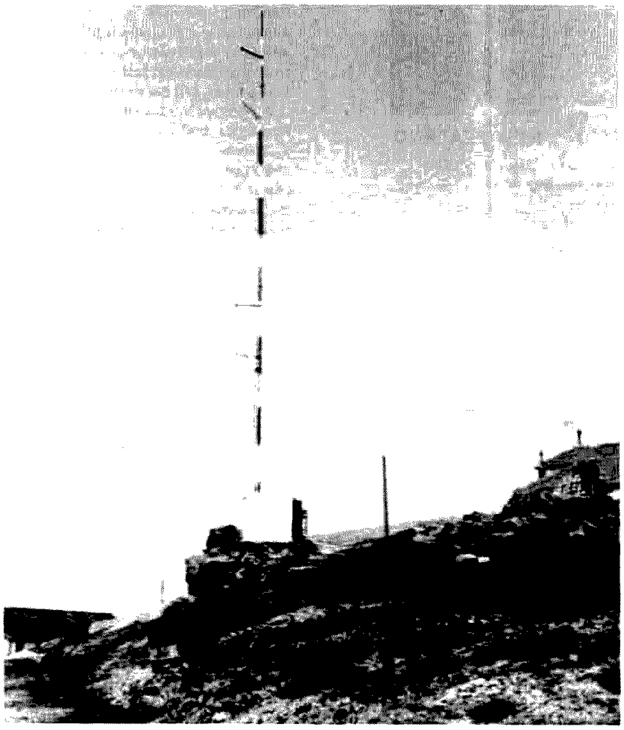


PORTUGAL

Luis Miguel de Sousa CT4UE
PO Box 32
S. Joao do Estoril 2765
Portugal

Here we go to introduce you to another ham association and its activities along the year: ARN (Associacao de Radioamadores do Nordeste). This club was founded on the 27th of January, 1984.

Situated in a town known as Braganca, it has a lot of enthusiasts ready for hard work. At this time of writing, it has 60 reg-



VHF repeater R3, 100 feet high, on Nogueira Hill, near Braganca. (Photo by ARN)

Inaugural day for the repeater, with some EA operators also there. (Photo by ARN)

istered members, most of them licensed hams with their own callsigns.

For those preparing a tour next summer, Braganca is right in the north, in the province of Tras-os-Montes (over the mountains). The name of this province reflects the mountainous character of the region. It is adjacent to the Spanish border. This remote northeast corner of Portugal was the home of Portugal's last royal house, the House of Braganca.

Currently, the ARN is preparing rules for a permanent award, and as soon as we have more details on this we will print them at once. (Award hunters, don't give up!)

Up there, just on the top of Nogueira Hill, there is a VHF repeater (R3), a 100-foot tower, and all the other components that we usually have in a good repeater. The station itself is situated about 1,350 meters from sea level.

On inaugural day, June of 1984, a lunch took place to celebrate the event, and among others, several Spanish hams were in attendance (a few EA operators do belong to ARN).

ARN projects for the future include:

- a technical public library especially for the young and newcomers
- a new ham station for its headquarters
- a VHF/UHF repeater to improve any emergency traffic in the northern part and neighboring areas
- a working group to establish some sort of cooperation with the local scouts for Jamboree On The Air activities in the future.

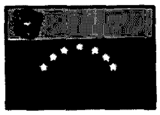
For additional information concerning this association, write to ARN, PO Box 34, Braganca 5300, Portugal.

QRM STRONGER THAN EVER

It is so common to hear whistles, steady carriers, and all sort of gremlins on the bands today when we are talking to someone. Let me tell you, sometimes I don't really know where good sense and respect for others have gone. Fortunately, we have exceptions. (Thanks to that, I'm still active.) Recently I was in a net and got sick from the things I heard. For heaven's sake, guys, don't do that, and never in a middle of the net operation. Be gentleman, and we will have a decent hobby.

I still remember when I was 14 years old and received my first license. I was just tuning up the rig with all that fourteen-year-old enthusiasm when a big shout came from my father: "What the hell are you doing, son? Have you checked out the frequency? Never do that again, or you will be in trouble with me! You got it?"

Twelve years have gone by, but I still remember this important rule: ***Always ask, "Is this frequency in use?"***



VENEZUELA

Luis E. Suarez OA4KO/YV5
Apartado 66994
Caracas 1061-A
Venezuela

This month's column is devoted to call area 4 (Circuito 4) in this country. It is composed of the states of Carabobo, Aragua, and Cojedes, all located in the northern-central side of the country, facing the Caribbean Sea.

Cojedes State

The capital city of the state is San Carlos. It was founded by the Capuchin friars in 1678 and named for the saint who had been the Cardinal San Carlos of Austria. The city is situated in the midst of a booming region of ranching and rice, corn, sesame, cotton, and tobacco growing. The most highlighted city spot is the road-racing track, built on the northern outskirts in 1970, with seating capacity for 20,000 fans. Each March, San Carlos becomes, briefly, the center of the motorcycling world, when the trials and first race of the World Championship Series are run. The track's 2700 meters and seven curves are used also for international formula car races. But believe me, it gets terribly hot, with temperatures around 40 degrees centigrade, some 100 degrees Fahrenheit!

Carabobo State

Carabobo is by far the most flourishing industrial state in Venezuela. Its capital is Valencia. The site was selected during December, 1553, because it was a good place to raise cattle. The founder, Captain Vicente Díaz, bought animals in Margarita Island and drove them to Valencia in a 6-month trip. At that time, most people moved away from the coast to escape from marauders and pirates, but Valencia was not far enough to discourage attacks. In the next 400 years, Valencia was attacked many times.

In 1801, Valencia had a population of 6,548 people, and even the cities in the vicinity, Maracay and La Victoria, were both larger. Then, on March 26, 1812, at seven minutes past four, an earthquake struck and turned Valencia, Barquisimeto, Trujillo, and Merida into ruins. Ten thousand people died in Caracas, and all but three houses were destroyed in La Guaira, the port located 25 kilometers north from Caracas.

These calamities were followed by the battles of independence. It was near Valencia where the battle of Carabobo took place (June 24, 1821). There is a monument in that place that well deserves a visit. It is the most beautiful monument I have ever seen in South America and maybe represents not only the Battle of Carabobo but the independence of all Latin American countries as well.

The impressive monument in bronze and stone is located on the site of the battle itself and extends down a long formal avenue. A scale model at the information booth can be studied before you begin your walk. There you learn how the Spanish troops of General Miguel de la Torre faced the carefully-coordinated regiments under the command of Simon Bolivar, the lancers of Jose Antonio Paez, and the British Legion. The battle which followed is still studied in military schools as a masterpiece of strategy. 1000 soldiers died in an hour, including most of the officers of the British Legion. The most remembered death was that of Lt. Pedro Camejo, named Negro Primero (Number One Black), who rode up to General Paez at the height of the battle to cry: "My General, I have come to say good-bye, for I'm dead," and fell lifeless at his feet.

Visitors can see a 12-minute fragment of history in a Diorama cubicle with 22 minutes of explanation of the battle, with an electronic scale model in the Mirador, from which the panorama encompasses the whole battlefield. There is a lot of walking since the Mirador is 1 kilometer from the monument. Ten soldiers in the red uniforms of the times stand at attention, flanking the Tomb of the Unknown Soldier. There is a changing of the guard every two hours. If you ever come to Venezuela, don't forget a visit to this place.

It is noteworthy that Valencia was the country's capital three times, the last from 1859 to 1860. This did not mean the eclipse of the city. The first electricity plant in South America was erected here in 1876, and Valencia claims to be the first city on the continent to have had electric streetlights. There were no amateur-radio stations at that time, otherwise they also would have had the privilege to run on power supplies instead of batteries.

Aragua State

Aragua State is located to the east of Carabobo. It is the central agricultural zone (also radio call area 5). Its capital is situated on the northern shore of Lake Valencia and is just an hour car trip from Caracas. There are a number of national and recreational parks, of which the lake of Zuata is, to me, a particularly nice place. I have had the pleasure of flying a radio-controlled Catalina PBY model there, and believe me, I will never forget that day. After some 6 minutes of the first flight, I maneuvered the plane into an approach to land in a perfect smooth turn and dive, into the wind: the usual procedure: throttle back to half thrust, flaps down to 25 degrees. The plane came very easy and I throttled back to near idle when it was about 1 meter above the lake surface; it's a heavy ship and some speed is necessary for landing. The slightly nose-up attitude was near perfect. Suddenly, engine number two quit, causing the ship to swerve to one side and to plunge into the lake surface. The beautiful 2-engine Catalina, crashed and slowly sank. I lost 5 months of hard work, two motors, radio, batteries, and a beautiful PBY during the first and only six-minute flight.

On the way back to Caracas I even forgot to turn on the 2-meter radio, for I was trying to figure out just what happened. It was not pilot error, this time...

At the time of the Spanish conquest, the valley belonged to Cacique Maracay and his Aragua Indian tribe. Around the middle of the 16th century, a settlement began to grow here. The city of Maracay since then has become a city of high rises. It has six institutions of high learning and hundreds of factories located in its five industrial zones. Although it has more than 400,000 inhabitants, Maracay is still called the Garden City of Venezuela, as it has more square meters of green area than any other city in this country.

All the area of Circuito 4 is surrounded by mountains, so there are many repeater sites around here. The most notable are Pico Platillon, El Cafe, and El Socorro. Platillon is the best repeater site in Venezuela. It is very high and is located facing the plains to the south of the mountains. From this mountain you may link half of the country.

During the visit of Pope John Paul II, the Radio Club of Valencia commemorated that event with a special operation, using call 4M4SS during the period January 26–28. You may send QSL cards to PO Box 510, Valencia. The prefix 4M is used only for special events such as the operation from the Angel Fall, this past year, using the call 4M5ARV/6. The operation from the waterfall was organized by the Asociacion de Radioaficionados de Venezuela.

MAPS

Yes, I still like maps. City maps (not souvenir or tourist maps). If you would like a map of Caracas, just send me your city map. (Sorry, I have too many from some cities.) I have not received any maps from Europe! I will appreciate very much maps from Juneau, Honolulu, Sioux Falls (South Dakota), Tokyo, Moscow, Peking, Amman (perhaps King Hussein JY1 is reading this column!), Cairo, and specially Lima (Ohio) and Peru (Indiana). But any city is welcome. I wish to mention that some guys send more than one map. I really appreciate this, but I can only send just the map of Caracas in return.

A CASE OF PIRATING

Yesterday, February 14, at around 0200 UTC, I was tuning the 20-meter band. As expected, propagation was really bad and I heard just a couple of weak stations from Argentina. Then I heard the call of OA4BLY calling a station in Panama. Then he moved a little and called the station in Argentina I heard a minute before. The Peruvian station signed OA4BLY/MM and said he was sailing off the coast of Colombia heading to Panama, thus in the Pacific. His signal was S-9 plus 30 dB at my FRG-7700 and with a short indoor vertical collapsible antenna. No QSB, and also I heard some noise in the transmission background.

The guy at the speaker was no doubt Peruvian, for the accent was typical. But he was not sailing, I'm sure. In fact his transmission origin was, no doubt, not far from my QTH to the east of Caracas. I became so upset about this hoax that I switched off the radio and grabbed the *Callbook*. No OA4BLY. Also checked the *Amateur Radio Guide* of the Peruvian Radio Club and found no OA4BLY. Probably I'm wrong and he is legally licensed in Peru, but for sure he was not sailing off the Colombian shores. I feel very bad about this, and also feel very angry when I receive QSL cards at my address in Peru for a QSO I never did, for I'm residing in Venezuela for the 12 years.

HAM HELP

Would someone please help me find a schematic and instruction manual for the General Radio Impedance Bridge type 1650-A? I will gladly pay any cost incurred.

Torgny Karlsson SM7CFQ
Sandormsvagen 7
S-280 41 Nyhamnalaga
Sweden

I sorely need a functioning Califone AV-25 or equivalent, or just the circuit board, mike, jack panel, and battery door.

J. Spencer Thornton
Box E 142902
Jackson MI 49204

I need a copy of a manual for a military-type rf signal generator, model TS-510A/U.

Brian Iehl KA9MOE
4213 N. Ridgeway
Chicago IL 60618

Are there any Timex-Sinclair computer magazines or newsletters still being published? If so, what are their addresses? I'm also looking for a list which will give the "civilian" numbers for military VT tubes.

Gary Payne KE6CZ
1347 Dakota
Fresno CA 93704

DEALER DIRECTORY

Culver City CA

Jun's Electronics, 3919 Sepulveda Blvd., Culver City CA 90230, 390-8003. Trades 463-1886 San Diego, 827-5732 (Reno NV).

Fontana CA

Complete lines ICOM, DenTron, Ten-Tec, Mirage, Cubic, Lunar, over 4000 electronic products for hobbyist, technician, experimenter. Also CB radio, landmobile. **Fontana Electronics, 8628 Sierra Ave., Fontana CA 92335, 822-7710.**

San Jose CA

Bay area's newest amateur radio store. New & used amateur radio sales & service. We feature Kenwood, ICOM, Azden, Yaesu, Ten-Tec, Santec & many more. **Shaver Radio, Inc., 1775A S. Winchester Blvd., Campbell CA 95008, 370-6665.**

New Castle DE

Factory Authorized Dealer! Yaesu, ICOM, Ten-Tec, KDK, Kenwood, AEA, Kantronics, Santec. Full line of accessories. No sales tax in Delaware. One mile off I-95. **Delaware Amateur Supply, 71 Meadow Road, New Castle DE 19720, 328-7728.**

Preston ID

Ross WB7BYZ has the largest stock of amateur gear in the Intermountain West and the best prices. Call me for all your ham needs. **Ross Distributing, 78 So. State, Preston ID 83263, 852-0830.**

Littleton MA

The reliable ham store serving NE. Full line of ICOM & Kenwood. Yaesu HTs, Drake, Daiwa, B&W accessories. Curtis & Trac keyers. Larsen, Hustler, Telex/Hy-Gain products. Mirage amps., Astron P.S., Alpha Delta protectors, ARRL & Kantronics instruction aids. Whistler radar detectors. Full line of coax fittings. **TEL—COM Electronic Communications, 675 Great Rd. (Rt. 119), Littleton MA 01460, 486-3400/3040.**

Derry NH

Serving the ham community with new and used equipment. We stock and service most major lines: AEA, Astron, Azden, B&W, Cushcraft, Hy-Gain, Hustler, ICOM, Kenwood, KLM, Larsen, Mirage, Mosley; books, rotors, cable and connectors, Business hours 9-7 Monday through Thursday, and 9-5 Friday and Saturday. **Rivendell Electronics, 8 Londonderry Road, Derry NH 03038; 434-5371.**

Albany, New York UPSTATE NEW YORK

Kenwood, ICOM, Ten-Tec, Belden, Cushcraft, Larsen, Hustler, ARRL, Hy-Gain, B&W, MFJ, Mirage. New and used equipment. Serving the amateur community since 1942. **Adirondack Electronics, Inc., 1991 Central Avenue, Albany NY 12205, 456-0203** (one mile west of Northway exit 2W).

Columbus OH

The biggest and best ham store in the Midwest featuring Kenwood and other quality products with working displays. We sell only the best. Authorized Kenwood service. **Universal Amateur Radio, Inc., 1280 Aida Dr., Reynoldsburg (Columbus) OH 43068, 866-4267.**

DEALERS

Your company name and message can contain up to 25 words for as little as $150 yearly (prepaid), or $15 per month (prepaid quarterly). No mention of mail-order business or area code permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the October '85 issue must be in our hands by August 1st. Mail to 73 Magazine, Peterborough NH 03458. ATTN: Nancy Ciampa.

PROPAGATION

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA						20	20					
ARGENTINA	20	20	20	40			20	20	15	15	15	15
AUSTRALIA		20	20	20	40	40	20					
CANAL ZONE	15	40	40	40	40[1]	40		15	15	15	10	10
ENGLAND			40[1]	40			20	20	20	20	20	20
HAWAII			20		40		20					
INDIA												
JAPAN						20	20					
MEXICO	15	40	40	40	40[1]	40		15	15	15	10	10
PHILIPPINES							20					
PUERTO RICO	15	40	40	40	40[1]	40		15	15	15	10	10
SOUTH AFRICA			40	40		20	20				20	
U.S.S.R.							20	20		20		
WEST COAST	20	40	40	40[1]	40[1]	40						20

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA		20	20					20	20			
ARGENTINA	15	20	20	40			20	20		15	15	15
AUSTRALIA	15	20	20	20	40[1]	40		20			20	
CANAL ZONE	15	20	20	20	40[1]	40	20	20	15	15	15*	10
ENGLAND	20	40					20	20		20	20	20*
HAWAII	15	15	20	20	20	40	20	20				
INDIA												
JAPAN		20	20					20	20			
MEXICO	15	20	20	20	40[1]	40	20	20	15	15	15*	10
PHILIPPINES		20	20				20	20				
PUERTO RICO	15	20	20	20	40[1]	40	20	20	15	15	15*	10
SOUTH AFRICA							20				20	20
U.S.S.R.								20			20	

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA		20	20						20			
ARGENTINA	15	20	20	40	40			20	20		15	15
AUSTRALIA		20	20	20	20	40[1]	40[1]		20		15	15
CANAL ZONE	15	15	20	20[1]	40[1]	40		20	20	15	15	15
ENGLAND	20							20	20			20
HAWAII	20	15	15	20	20	20[1]	40[1]	40	20		20	20
INDIA				20					20			
JAPAN		20	20						20			
MEXICO	15	15	20	20[1]	40[1]	40		20	20	15	15	15
PHILIPPINES				20					20			
PUERTO RICO	15	15	20	20[1]	40[1]	40		20	20	15	15	15
SOUTH AFRICA			40						20			
U.S.S.R.									20			
EAST COAST	20	40	40	40[1]	40[1]	40						20

1 = Possible 80-meter openings.
*** = Check next higher band.**

G = Good, F = Fair, P = Poor.

JULY

SUN	MON	TUE	WED	THU	FRI	SAT
	1 G	2 F	3 G	4 G	5 G	6 G
7 G	8 G-F	9 F	10 F-P	11 F	12 F-G	13 G
14 G-F	15 F	16 F-G	17 F-P	18 P	19 P	20 P-F
21 F-G	22 G	23 G	24 G	25 G	26 G	27 F
28 G	29 G	30 G	31 G			

Issue #299

OUR 25th ANNIVERSARY YEAR!

August 1985
$2.50 USA
$3.50 Canada

73 for Radio Amateurs

A CWC/P Publication

International Edition

SUMMER SIZZLER:
2M TRANSCEIVER FROM DOWNUNDA

The Last HW-101 Mod?

INSTANT ATV!

Hunting the Auto-Fox

WWII's Razor Radio

New VHF/UHF Column:
Above and Beyond

0 8
0 74470 65946

73 for Radio Amateurs®

ISSUE #299 AUGUST 1985

On the Cover:
CWC/P's Margaret Baker, Creative Director, Marketing/Graphic Services Division, was captured on film by Frank Cordell of Bennington NH. FT-209RH courtesy of Yaesu Electronics Corporation, Paramount CA.

4 **What?**
7 **QRX**
67 **Circuits**
68 **New Products**
69, 77 **Ham Help**
70 **Review**
72 **RTTY Loop**
73 **Satellites**
74 **Barter 'N' Buy**
74 **Special Events**
78 **Be My Guest**
78 **Above and Beyond**
79 **DX**
82 **Letters**
83 **Contests**
84 **Fun!**
88 ***73* International**
94 **Dealer Directory**
94 **Propagation**
95 **List of Advertisers**

14 The Downunda Project: Part I
Stone the crows! This fair dinkum 2m transceiver from Australia really scores a six! .... Simpson

29 Harmonic-Free QRP?
Avoid an FCC pink slip by measuring second-harmonic power with the ZS6UP reactance load. ZS6UP

32 World War Wireless
What can you do with a pencil, a razor blade, a paper clip, and a hank of wire? Why, build a radio, of course! W1BG

36 Instant ATV!
W8CHK breaks through the mystique surrounding fast-scan television. You won't believe how easy it can be! W8CHK

42 Modification Mania!
Here are not five, not ten, but *fifteen* ways to perk up your HW-101. .... AI7C

48 Hunt the Auto-Fox
Has your transmitter-hunting gone sour? DFers will love chasing this wily box, and its variable skill levels give them a run for their money. WB6GTM

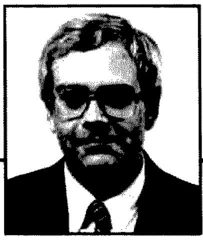
52 Surviving the Unthinkable: Part III
WA8YKN outlines simple precautions that will allow your radio equipment to survive an electromagnetic pulse. WA8YKN

56 Scope That Signal
Are you overmodulating? Is your linear linear? Find out with a station monitor you've built from scratch. KD6VP

66 A Scavenger's Radio
Using it is easier than building it. KA0DMT

Editorial Offices: Pine Street, Peterborough NH 03458, phone: 603-924-9471. **Advertising Offices:** Elm Street, Peterborough NH 03458, phone: 603-924-7138. **Circulation Offices:** Elm Street, Peterborough NH 03458, phone: 603-924-9471. **Manuscripts:** Contributions in the form of manuscripts with drawings and/or photographs are welcome and will be considered for possible publication. We can assume no responsibility for loss or damage to any material. Please enclose a stamped, self-addressed envelope with each submission. Payment for the use of any unsolicited material will be made upon acceptance. All contributions should be directed to the *73* editorial offices. "How to Write for *73*" guidelines are available upon request. US citizens must include their social security number with submitted manuscripts. **Subscription Information:** Rates: in the United States and Possessions: One Year (12 issues) $24.97; Two Years (24 issues) $38.00; Three Years (36 issues) $53.00. Elsewhere: Canada and Mexico—$27.97/1 year only, U.S. funds. Foreign surface mail—$44.97/1 year only, U.S. funds drawn on U.S. bank. Foreign air mail—please inquire. To subscribe, renew or change an address: Write to Subscription Department, PO Box 931, Farmingdale NY 11737. Send Canadian changes of address to: 73, PO Box 1051, Fort Erie, Ontario CANADA L2A 5N8. Return postage guaranteed. For renewals and changes of address, include the address label from your most recent issue of *73*. For gift subscriptions, include your name and address as well as those of gift recipients. For questions concerning your subscription and to place subscription orders, please call us toll free at 1-800-645-9559 between 9 am and 5 pm or write to *73*, Subscription Department, PO Box 931, Farmingdale NY 11737. *73 for Radio Amateurs* (ISSN 0883-234X) is published monthly by CW Communications/Peterborough, Inc., 80 Pine Street, Peterborough NH 03458. Second class postage paid at Peterborough NH 03458 and at additional mailing offices. *Canadian second class mail registration number 9566.*

Microfilm Edition—University Microfilm, Ann Arbor MI 48106. Postmaster: Send address changes to *73*, Subscription Services, PO Box 931, Farmingdale NY 11737. Nationally distributed by International Circulation Distributors.



WHAT? *News from the Publisher*

Dr. Marc Leavey WA3AJR celebrated his *eighth* anniversary with *73* earlier this year, and I did want to make sure that his hard work and ninety-six-plus "RTTY Loop" columns didn't go unrecognized. In our reader polls over the years, "RTTY Loop" has always ranked right up near the top of the preferred features list, a reflection no doubt not just of continuing interest in radioteletype, but also of the skill and care evident in WA3AJR's column every month. Thanks, Marc!

Our appreciation and congratulations go also to Bob Baker WB2GFE, our "Contests" columnist, who this month marks his *tenth* anniversary with *73*. As WA1SCX in 1975, Bob found himself president of a newly-formed ham club at Digital Equipment Corporation. "One of our very first programs was a talk given by Wayne Green, who had been invited down for the evening. After dinner, I joked about *73* not having a contest column. I was challenged to start something and that's how the contest calendar got started." The author of more than 75 published articles, Bob is now the Manager of Software Development for Datamedia Corporation in Pennsauken, New Jersey, and owner of his own small supplies and software business, Baker Enterprises. Fortunately for us all, he still finds time for contesting, DX, and county hunting, and—most important—for writing our "Contests" column. On behalf of our staff and readers, Bob, many thanks and best wishes for *at least* another successful ten!

Speaking of columns, I call your attention to Perry KW1O's "QRX" this month, where you'll find news of proposals approved by the ARRL Executive Committee to enhance Novice privileges. The idea here is not just to attract new Novices, but to retain them in the Amateur Radio Service—to make Novice operation and opportunities more FUN. Please drop me a line and let me know what you think about these ideas. We think they have merit.

The mailbag does continue to be full every day, and we do thank you for taking the time to send along your thoughts and comments, your QSLs, your club newsletters, and news items of interest about everything under the sun. We're always interested in what's going on in your neck of the woods, and the best way we find out is by you letting us know what's happening. Here's a reminder, too, that we do make random follow-up calls to letter-writers to talk in greater depth with them about their ideas for amateur radio and for *73*. This month's calls went to hams in the states of New Hampshire, New York, and California, as well as to one in London.

This month's *incoming* call-of-the-month was great. We were in the midst of some very severe weather—high winds, torrential downpour, yellow-brown skies. The phone rang (beeped actually) and the caller identified himself as a New Hampshire ham. It was important, he said—he had to speak to KW1O. Well, there was a real sense of urgency in his voice and New Hampshire *has* had tornadoes, so I left the phone off the hook and scrambled to find Perry. I told him I thought it could be an emergency, and Perry rushed into my office and picked up the phone. Then he rolled his eyes and smiled. No emergency. The guy was just *really* excited about getting on computerized RTTY as soon as possible. Could we tell him how? Another new fan for "RTTY Loop"!

Jack Burnett

MPA

73 for Radio Amateurs is a member of the CW Communications/Inc. group, the world's largest publisher of computer-related information. The group publishes 57 computer publications in more than 20 major countries. Nine million people read one or more of the group's publications each month. Members of the group include: Argentina's *Computerworld/Argentina;* Asia's *The Asian Computerworld;* Australia's *Computerworld Australia, Australian PC World, Macworld* and *Directories;* Brazil's *DataNews* and *MicroMundo;* China's *China Computerworld;* Denmark's *Computerworld/Danmark, PC World* and *RUN* (Commodore); Finland's *Mikro;* France's *Le Monde Informatique, Golden* (Apple), *OPC* (IBM) and *Distributique;* Germany's *Computerwoche, Microcomputerwelt, PC Welt, SoftwareMarkt, CW Edition/Seminar, Computer Business, RUN* and *Apple's;* Italy's *Computerworld Italia* and *PC Magazine;* Japan's *Computerworld Japan;* Mexico's *Computerworld/Mexico* and *CompuMundo;* The Netherland's *Computerworld Benelux* and *PC World Benelux;* Norway's *Computerworld Norge, PC World* and *RUN* (Commodore); Saudi Arabia's *Saudi Computerworld;* Spain's *Computerworld Espana, Microsistemas/PC World, Commodore World;* Sweden's *ComputerSweden, Mikrodatorn* and *Svenska PC;* the UK's *Computer Management, Computer News, PC Business World* and *Computer Business Europe;* Venezuela's *Computerworld Venezuela;* the US's *Computerworld, Hot CoCo, inCider, Infoworld, MacWorld, Micro Marketworld, PC World, RUN, 73, 80 Micro, Focus Publications* and *On Communications.*

QRX. . .

EDITED BY PERRY DONHAM KW1O

Novice Phone?

THE ARRL EXECUTIVE COMMITTEE has approved a plan which would allow Novices greater privileges, including phone operation on three bands. The proposal, developed by the League's headquarters staff, calls for Novice voice and data transmission on the 28-, 220-, and 1200-MHz bands. On ten meters, Novices would be allowed CW and data emissions from 28.1 to 28.3 MHz and CW and SSB from 28.3 to 28.5 MHz. From 220 to 225 MHz, they would be given all voice and data modes with a power limitation of 25 Watts output and a prohibition against operating a repeater. Between 1246 and 1260 MHz, privileges would be similar to those on 220 MHz, with an output limit of 5 Watts. The plan also calls for an increase in the number of questions in the Element 2 examination from 20 to 30 to reflect the added responsibility of the new modes of operation. Technicians, of course, would gain the new HF authorization. So that General-, Advanced-, and Extra-class ticket-holders do not feel slighted, they would be able to use full output power within the new Novice subbands. Please note that approval by the Committee is only a first step on the road to proposed rulemaking. FCC Special Services Division Chief **Ray Kowalski**, in a telephone interview with the *W5YI Report*, said, "Expanding Novice privileges is not being considered in response to a problem, but rather to...keep amateur radio attractive and vital with new blood." *73* will keep you up to date on this important issue through this column and the *73* RBBS at (603)-924-9809.

Micro DX

A NEW NORTH AMERICAN DX RECORD on 1296 MHz may have been set by **Ott Febel W4WSR** and **Wes Atchison WA5TKU.** Ott and fellow experimenter **Al Ward WB5LUA** tried for nearly a year to bridge the 1073-mile gap between their stations and establish a new terrestrial 1296-MHz record. Not until June 3, 1985, did favorable conditions appear. In Ott's words, "I commenced our sked at 0100 UTC and stood by. Al came back with such a signal that I thought it was a local trying to break in! We immediately switched to SSB and exchanged 59+ reports. Boy, when this band opens, it *opens!* We switched to 70 cm to spread the good news...Wes WA5TKU joined...and we proceeded to try our luck on 23 cm. Wes is another 39 miles west of Al and doesn't have near the setup Al has, but we had to try anyway. At 1137 UTC I copied Wes RST 529 and he gave me a 549. To the best of my knowledge, this contact establishes a new North American record of 1112 miles!" Poor Al had waited nearly a year to hold the record for only a few minutes.

Kansas Sitting

A UNANIMOUS VOTE of the Kansas Repeater Council will keep that state on the 15-kHz repeater band plan. Meeting in Salina, the group heard reports from **Frank Park** and **Joe Eisenberg** concerning the technical and compatibility aspects of 15- versus 20-kHz splits. In approving the proposal to stay with the 15-kHz plan, the council also affirmed its desire to remain compatible with neighboring states Colorado, Nebraska, Iowa, and Missouri, all of which have also rejected the 20-kHz band plan.

Debutant

"ABOVE AND BEYOND," *73*'s new VHF/UHF column, debuts this month. **Peter Putman KT2B** will offer a variety of information each month, such as product reviews, grid-square news, expedition announcements, and operating techniques. You may recognize Pete's name from his amazing multiple-projector slide shows on contesting or his inventive construction articles. At home, he uses mainly home-brewed gear, with a kilowatt on 144 MHz, 120 Watts on 220 MHz, 500 Watts on 432 MHz, and 20 Watts on 1296 MHz. If you are a VHFer or would like to be one, why not drop Pete a note and let him know what sort of thing you would like to read about? His address is 84 Burnham Road, Morris Plains NJ 07950.

Soviet Solution

ARE YOU FRUSTRATED by having to wait such a long time for QSLs to arrive from the USSR? **Ed Kritsky KA2MXO** may have just the thing for your anxiety. Box 88 is not the only way to QSL the Russians, and to prove it Ed has produced a complete list of oblast-level QSL bureau addresses. In a story which appeared recently in the *DX'ers Magazine*, Ed says, "It is perfectly all right for you to QSL directly using this info. People who already have done it report very good results." Ed is selling the list for $4.95 and is using the money to send *Callbooks* and other ham-radio literature to Soviet amateurs. You can contact Ed at PO Box 715, Brooklyn NY 11230.

Radio Police

"DON'T BE A PROBLEM," said FCC Commissioner **Ray Kowalski** to a conference of repeater coordinators at the Dayton Hamvention. Kowalski, addressing a forum on VHF spectrum management, made it clear that he is concerned about the future of amateur radio. "The current political mode for dealing with problems is to get rid of them," he explained. "You are sitting on very valuable spectrum. There are sharks out there who have mentioned that spectrum and would love [to have] it. Think on how it plays in the halls of the FCC if someone says, 'This has become a problem service; let's get rid of it. It will go away and we can give that spectrum to people who need it [instead] of a bunch of hobbyists.' That's how it will play if it comes down to a solution to solve a problem. *Do not* become a problem." More specifically, the Commissioner chided hams for running so quickly to the FCC with every little problem. Kowalski reminded the group that amateur radio is a self-policing service and that we should be able to solve our problems with a minimum of regulatory action. "Don't come running to us for some kind of policy or rulemaking...you won't like the solution!"

Hot Turkey

AMATEUR RADIO HAS TAKEN OFF in Turkey! Soon after the Turkish Parliament passed a bill allowing hams back on the air, seven operators received their licenses and began to assemble stations. Currently four amateurs are active: **Unal Akbal TA1A, Salim Unuvar TA1B, Metin Kutlu TA1C,** and **Mehmet Basak TA1D.** The remaining three, who have not yet received callsigns, are **Tuncer Topdemir, Aziz Sasa,** and **Mustafa Tandogan.** More license examinations are planned, so the activity level from this country should begin to slowly rise as more and more stations are established. For now, look for TA1A and TA1C on 15 and 20 meters from 1800 to 2300 UTC daily.

YAP

PRESIDENT REAGAN is indirectly backing amateur radio in a big way through the **Young Astronaut Program (YAP).** YAP, a group which consists of at least 50,000 schoolchildren enrolled in nearly 2,000 chapters nationwide, is part of the White House Office of Private Sector Initiatives. YAP Director **Dr. Kerry Joels** met recently with ARRL Development Manager **Bill Laz-**

zaro N2CF to talk about integrating amateur radio into YAP. The discussion centered around linking YAP chapters with local amateur-radio clubs and about the possibility of a joint YAP-AMSAT satellite. Dr. Joels said that he had found "strong corporate enthusiasm" for a proposed geosynchronous system which would be underwritten by industry contributions. The Young Astronaut Program has an incredible potential for bringing ham radio directly to children who are at that wonderful age when everything is new and exciting.

Clear As...

THE FCC HAS RECONSIDERED its recent editorial change of Section 97.121 which attempted to clear up apparent confusion as to when an amateur could transmit a callsign other than his own (after **David Popkin W2CC** politely pointed out that the new rule implied that *any* use of another callsign was prohibited). Luckily, the Commission agreed and has now reworded the offending paragraph to specify that amateurs simply must not transmit false or deceptive signals, including identifying with a call that is not assigned to the station. Of course, a guest operator at your station may still sign with his own call, providing he stays within the limitations of his license. And "tactical" calls on nets are still OK as long as the proper method of identification for this type of operation is observed.

Mag Mod

A5 ATV MAGAZINE has changed both its format and its name. The new ***Spec-Com Journal*** features a larger page size and an expanded focus on all forms of specialized amateur communications. In response to concerns that fast-scan TV would not be adequately covered, publisher **Mike Stone WB0QCD** replied, "*A5*'s readers have become specialty operators in modes other than ATV. [But] fast-scan television is the first interest of *Spec-Com*, and a large percentage of the publication will always reflect this." Get complete details on this new magazine by writing to *Spec-Com Specialized Communications Journal*, PO Box H, Lowden IA 52255.

More Stuff!

THE FLOOD OF FREEBIES from *73* continues with this month's incredible bargain: a newly-updated list of Volunteer Examiner Coordinators. That's right, all 31 FCC-appointed VECs on one convenient reference sheet. But that's not all! Limited supplies of the **Giant Worked All States Map** (11" × 17") are still available. Now how much would you pay? But wait—we'll throw in a copy of the popular **Ten-Meter Beacon List**, an information-packed aid you'll use again and again. All of these fantastic values can be had for the same low price—a large SASE sent to *73* Magazine, Editorial Department, 80 Pine Street, Peterborough NH 03458, Attn: VEC List.

Armadillos, Ho!

THE ARMADILLOS ARE RUNNING AGAIN in Texas! In 1983, the members of the **Texas DX Society** decided to try their hand at county hunting by activating all 254 Texas counties during the County Hunters CW contest. Fewer than 60 hams covered 262,000 square miles in less than 48 hours to accomplish the feat. In 1984, the club expanded the "Armadillo Run," as it came to be called, to include the states of Arkansas, Louisiana, and Mississippi. Now the group has even bigger plans—a national Armadillo Run! That's right, they will attempt to activate *every county in the United States* during the County Hunters phone and CW contests in May and July of 1986. Plans are already well under way for this amazing event, but you can still arrange to be in on the fun by contacting the 1986 Armadillo Run Coordinator, Tom Taormina K5RC, Route 1, Box 307, Manvel TX 77578.

Bulletin Bored?

AN INCREDIBLE NUMBER of computer-based bulletin boards has sprung up around the country, including one here at *73*. We'd like to put together a directory of ham-related systems in the United States—but we need your help. Jot down information about your favorite amateur-radio RBBS, including telephone number, baud rates supported, and special features, and send it to *73* Magazine, Editorial Department, 80 Pine Street, Peterborough NH 03458, Attn: RBBS. We'll compile a bulletin-board mini-directory and make it available through "QRX."

Ham Hero

ALAN GERSHBEIN W4LTA narrowly escaped death recently with the help of ham radio. While walking along a beach in the Bahamas, Alan stepped on what he first thought to be a shell, but was in fact a deadly stonefish. Within a short time, Alan's foot and ankle had swollen to nearly twice their normal size, and excruciating pain was shooting up his leg. He began to have trouble breathing. Alan instructed his wife Nancy to call for emergency medical assistance on the 14.313 Maritime Mobile Net with his new Kenwood TS-430S. Even though Nancy is not a ham, she knew that 14.313 MHz was programmed into one of the 430's memory channels and succeeded in calling up the frequency to the vfo. Luckily, Alan had just installed a J. L. Industries Antuner, which automatically matched the antenna's impedance to the transmitter's. Nancy called net control operator **Randy Maurer WA3HLP**, who kept the frequency clear and relayed instructions from the Tampa Poison Control Center. Nancy followed the Center's directions, and Alan's relief (and Nancy's!) was almost immediate.

Spread Specs

SPREAD-SPECTRUM COMMUNICATION has been approved for amateur use on frequencies above 420 MHz, but there is a catch. Although the final ruling has been published, it will be one year before any transmissions will be allowed. This is, according to the FCC, "in order to give the amateur community time to develop initial voluntary interoperability standards as they have done recently in packet radio." In other words, time to get our act together. There also will be a limit of three possible spreading sequences so that monitoring stations won't have to step through an infinite number of possibilities, and identification must be made in CW, SSB, or FM. The FCC is encouraging experimenters to apply for STAs. If you are interested in helping explore amateur spread-spectrum, get in touch with the Amateur Radio Research and Development Corporation (AMRAD) at PO Drawer 6148, McLean VA 22106-6148.

Preview

COMING UP NEXT MONTH in *73*: Antennas! That's right, it's time to get out and build that new antenna before winter sets in. You'll find skywires for every type of operation and every budget. Plus, we'll show you how to build and align the DSE Commander 2m transceiver. Of course you'll see all of your favorite features, including "Above and Beyond," our new VHF/UHF column. October? Our gala **Silver Anniversary Issue!**

Bravo!

SINCERE THANKS to Paul Courson WA3VJB, Bill Pasternak WA6ITF, the *AMRAD Newsletter*, H. Veysel Guleryuz, the *W5YI Report*, Tom Taormina K5RC, Gus Browning's *DX'ers Magazine*, Wendell Wilson W0TQ, Ott Fiebel W4WSR, Louis Perlmutter W4LP, George Wood of Radio Sweden International, *The TSRAC BNT*, and *The ARRL Letter* for helping out with this month's news.

Leo Simpson
140 Joynton Avenue
PO Box 227
Waterloo NSW 2017
Australia

The Downunda Project: Part I

Stone the crows! This fair dinkum 2m transceiver from Australia really scores a six!

Reprinted with permission from *Electronics Australia*.

By any standard, the UHF transceiver described in the September, October, and November, 1983, issues of *Electronics Australia* has been an outstanding success. Many hundreds have been successfully built and the kit supplier responsible, Dick Smith Electronics, has not been able to keep up with the demand.

As the reputation of the UHF transceiver has grown, more and more amateurs have decided to have a go at building a really worthwhile piece of gear for themselves. At the same time, they can save a substantial amount of money over the price of an equivalent commercial unit.

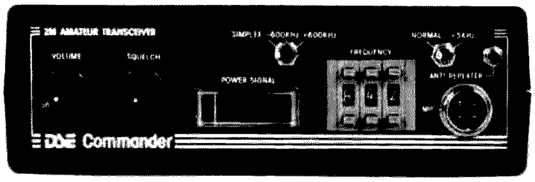


Photo A. The DSE Commander two-meter transceiver kit.

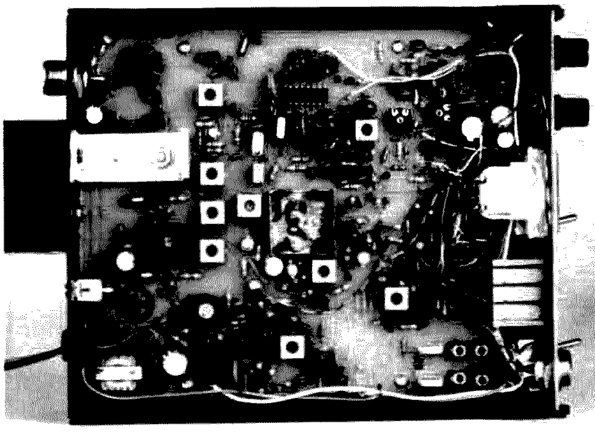


Photo B. Inside the Commander.

We're very glad to able to report this development because it signals a resurgence in the construction of gear amongst amateurs who, for a long time, have been content to buy rather than build.

Just as night follows day, there was bound to be a call for a two-meter version of the transceiver. The VHF version was just crying out to be produced.

Well, now it has happened. The same people that produced the UHF kit, Garry Crapp VK2YBX/T and Gill McPherson VK2ZGE, have put their thinking caps on and produced a two-meter transceiver that will certainly set any keen amateur longing.

Features

As the accompanying spec panel shows, this new two-meter transceiver has very good performance which is matched by the features that most amateur-radio operators want. Note also that there are very few options available because they are all built into the basic radio.

Operating facilities on the new transceiver are all that most amateurs would want without all the "bells and whistles" of some of the more fancy models. There are none of those hard-to-remember-how-to-use memories, and the frequency readout and selection is via no-nonsense push-button-type thumbwheel switches.

As is usual practice with two-meter amateur transceivers, the two most significant digits of the frequency section are omitted, which means that there is an assumed decimal point between the first and second digits of the three-digit readout (i.e., 14-.--MHz). In Photo A, this means that the transceiver is set for a frequency of 148.42 MHz.

Standard controls for volume and squelch require little comment, as does the signal-strength/power meter. The microphone socket is a standard configuration allowing press-to-talk operation.

In addition, there is a three-position switch for sim-

A complete kit is available for $149 plus postage and handling from Dick Smith Electronics, PO Box 2249, Redwood City CA 94063.

plex and ±600-kHz transmitter offset for working into repeaters. There is also an anti-repeater (reverse) button so that the transceiver can be used to listen in on the repeater receiving frequency.

Finally, there is the 5-kHz offset switch which effectively doubles the number of channels from 400 to 800, albeit with 5-kHz channel spacing.

How It Works

For those not familiar with the series of articles on the UHF transceiver, let's now go through the block diagram, before attacking the main circuit diagram. Refer now to Fig. 1.

The block diagram shows that the transceiver is split into two sections, receiver and transmitter, which come together in the antenna filter. Both sections employ a common frequency synthesizer and voltage-controlled oscillator.

The receiver is a conventional double-conversion superheterodyne with intermediate frequencies at 10.7 MHz and 455 kHz. The second conversion from 10.7 MHz to 455 kHz is achieved in an integrated circuit which also includes limiting amplifiers and an FM quadrature detector. From there the signal is passed to an audio amplifier.

The vco (voltage-controlled oscillator) has two modes and, as you might have guessed, these are transmit and receive. In the transmit mode, the vco is set to an exact frequency within the range of 144 to 148 MHz by the frequency synthesizer which, in turn, is controlled by the offset oscillator. The output of the vco is fed via Q17 and Q18 to the rf power amplifier and thence via the antenna filter circuit to the output socket.

In the receive mode, the vco is set at a frequency exactly 10.7 MHz below the incoming frequency. This is necessary to give the 10.7-MHz intermediate frequency at the output of the mixer, Q7. The lower vco frequency is obtained by switching a different crystal into the offset oscillator.

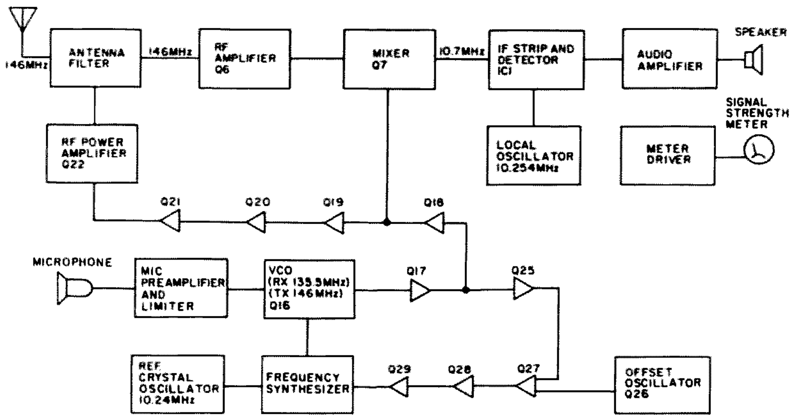


Fig. 1. Block diagram of the DSE Commander.

Circuit Details

Now let's have a look at the circuit diagram (Fig. 2). Don't shudder. We'll consider the receiver circuitry first.

"We are happy to give full rights to any kit or parts supplier to sell or reproduce the board or circuit for this project. We feel this is the best way for the whole industry...the more people there are who construct projects, the more hobbyists there will be benefiting all of us."—Ike Bain VK2AIG/W6, President, Dick Smith Electronics.

Input signals from the antenna are fed via the antenna filter and rf-switching network on the extreme right-hand side of the circuit diagram. The signals pass via L30, L29, L27, L26, L28, and C123. From there they go to the input of Q6 via transformer L2 and C11 (on the extreme left-hand side of the circuit).

The rf switching is performed by D13 (near L28, on the right-hand side of circuitry). In the transmit mode, D13 is forward-biased and thus shorts out any rf signal from the transmitter which would otherwise be fed into the receiver input.

Q6 is a conventional common-emitter amplifier with L3 as its collector load. L3 is part of the three-stage bandpass filter which only accepts signals in the 144-to-148-MHz range.

MOSFET Q7 is the mixer. Gate 1 of Q7 is the incoming rf signal while gate 2 is the vco (local-oscillator) signal. L6 is the drain load of Q7 and the mixer output is the difference frequency, 10.7 MHz. This is passed via FL1, a two-pole filter, to IC1.

IC1 is a Motorola MC3357 device specifically designed for use in a narrowband FM dual-conversion communications receiver, which is exactly what this circuit is. We have already talked about the first conversion, which takes place in mixer Q7, from 144 (to 148 MHz) down to 10.7 MHz. The MC3357 handles the second conversion using an internal 10.245-MHz local oscillator.

This gives a second intermediate-frequency signal of 455 kHz which is amplified, limited, and detected by IC1. IC1 also provides the squelch function.

In greater detail, crystal X1 at pin 1 of IC1 sets the local-oscillator frequency to 10.245 MHz. This is internally mixed with the 10.7-MHz signal from Q7 to produce a 455-kHz i-f, which is then fed to an external filter at pin 3. Transistor Q8 amplifies the filtered 455-kHz signal and feeds it back into the limiting-amplifier input at pin 5.

The limiting amplifier is a five-stage differential amplifier which boosts the 455-kHz signal well into clipping, at its output. That is, we say the signal is limited. This effectively removes any amplitude variations (AM) so that the signal only contains frequency modulation.

The limited signal is then fed to the internal FM quadrature detector associated with coil L7 and capacitor C37 at pins 7 and 8.

The detected audio is extracted from pin 9 and fed via R33 and C35 to VR40, the volume control. At the same time, a sample of the signal is coupled via R32 and C33 to an internal amplifier between pins 10 and 11.

This amplifies any noise signal (hiss) above the expected audio passband which is then rectified by D7 and used to "squelch" the audio output via control pin 12. VR39 is the squelch control.

Transistor Q8 feeds a portion of the 455-kHz signal (before limiting is applied) to

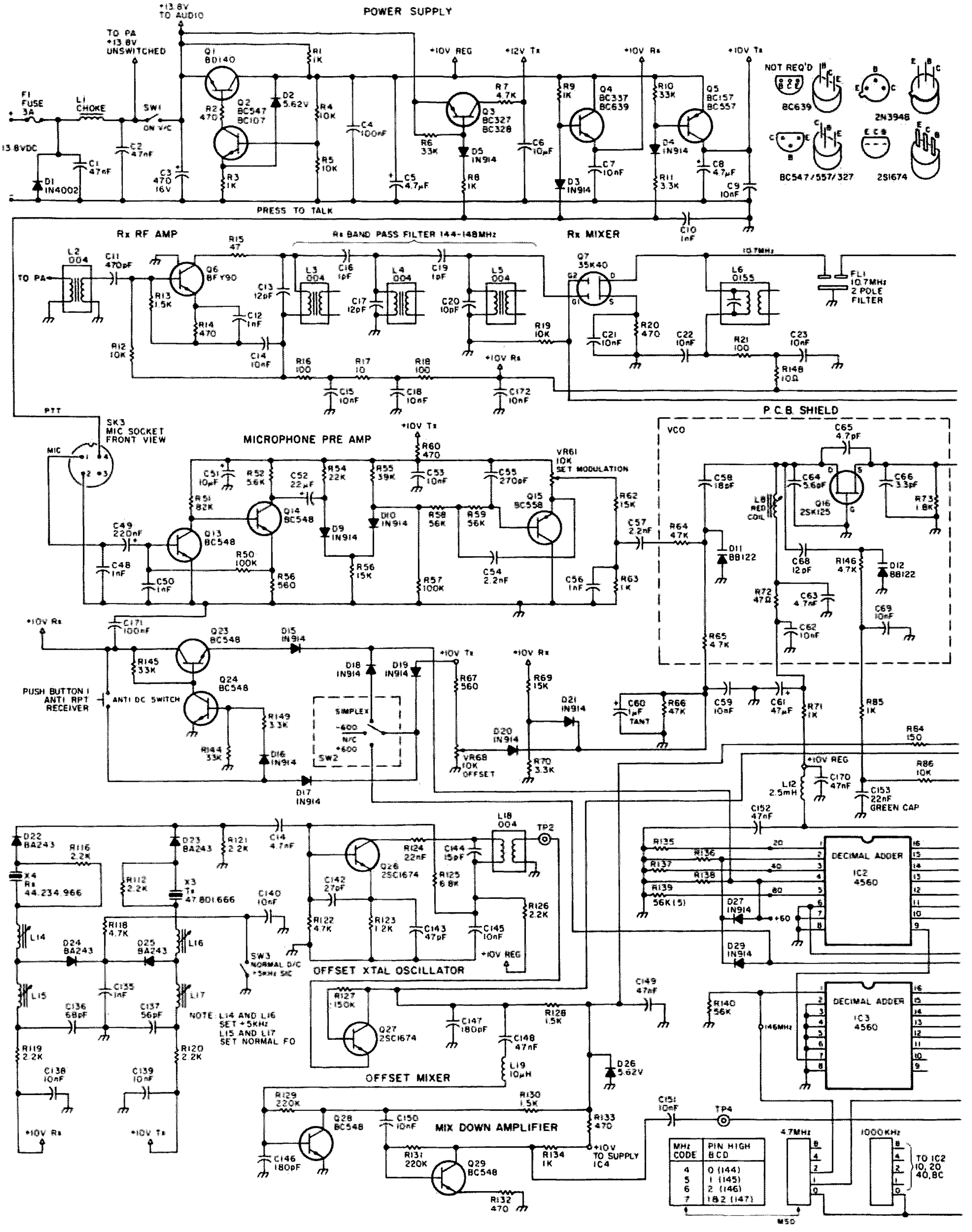
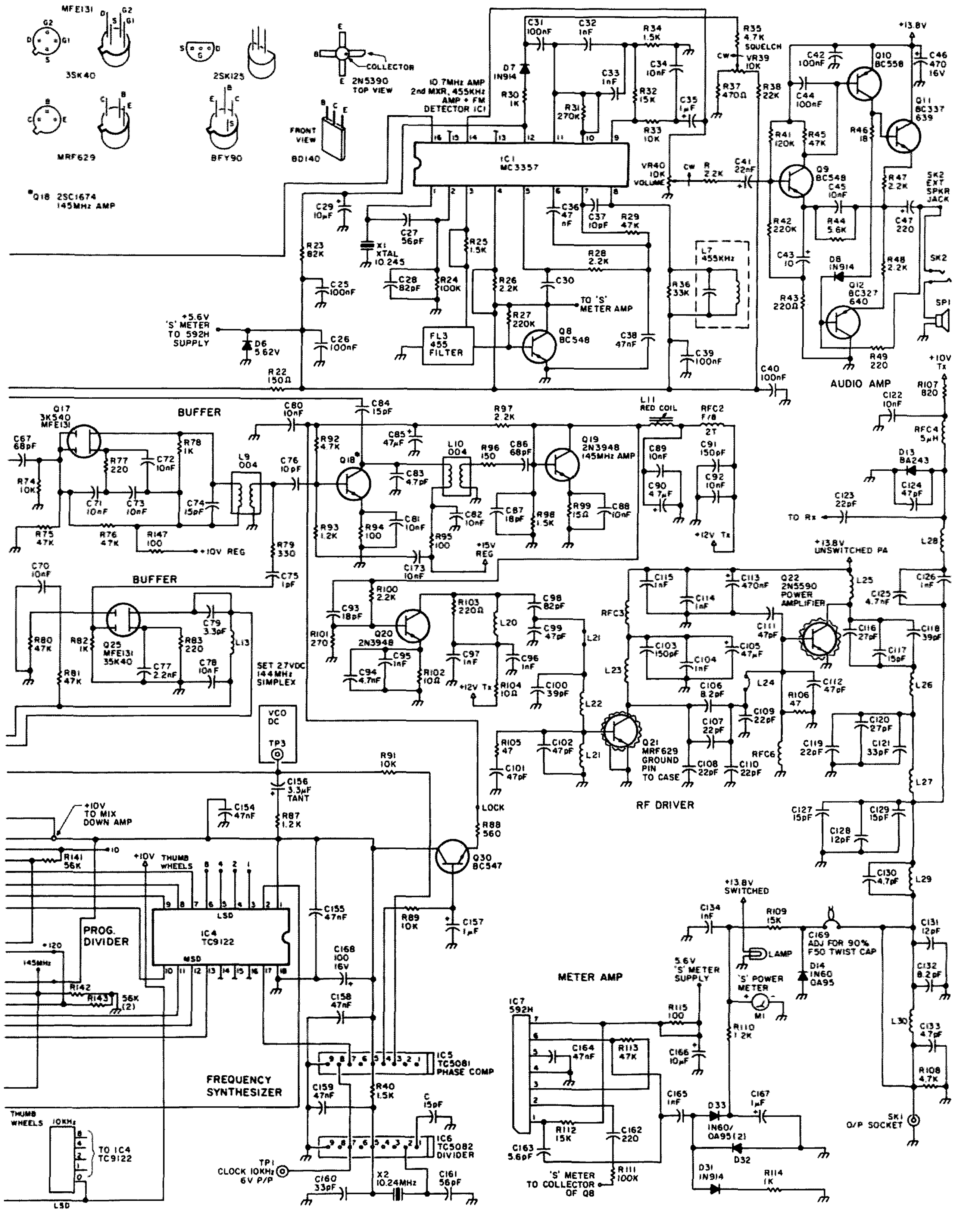


Fig. 2. Schematic diagram.

IC7, the meter amplifier. This produces an indication of signal strength when in the receive mode.

Transistors Q9 to Q12 form a conventional audio amplifier. Q9 is a straightforward common-emitter stage with negative feedback applied to the emitter via R44. Q10 is a class-A driver with bootstrapping via the output capacitor, C47. Its collector load is R49 and the speaker itself.

If the speaker is discon-



nected for any reason, the whole amplifier will latch up, which is how it manages to withstand open circuits continuously (see specs).

Q11 and Q12 form a fully complementary output pair with quiescent current set by R46 and D8. R47 and R48 are rather high in value at 2.2 Ω, which gives good bias stability, limits the power output to some extent, and gives momentary short-circuit protection.

Resistors R44 and R43 set the audio amplifier gain to around 25 (i.e., 5600/220 = 25) while C45 rolls off the response above 3 kHz.

Specifications

General	
Frequency coverage	144 to 148 MHz (see text)
Channel spacing	10 kHz, with 5-kHz offset
Number of channels	400 @ 10 kHz, 800 @ 5 kHz (see text)
Frequency stability	within ±10 ppm from 0 to 60°C
Modulation	frequency modulation
Temperature range	from 5 to 50°C
Duty cycle	two minutes transmit, two minutes receive
Supply voltage	12 to 15 V dc, test voltage 13.8 V dc
Polarity	negative chassis
Current drain	receive: muted, 110 mA; unmuted, 300 mA transmit: 1.9 A at 10 W; 2.5 A at 15 W
Protection	(a) 3-A in-line fuse (b) diode reverse polarity protection (D1) (c) rf power amplifier can withstand up to 5:1 vswr and open- or short-circuit conditions for at least two minutes (d) audio power amplifier can withstand open circuits continuously and momentary short circuits
Transmitter	
Power output	10 Watts nominal, 15 Watts maximum
Maximum deviation	limited to 5 kHz under normal operation; up to 10 kHz with overdrive
Distortion	less than 10% at 3-kHz deviation
Spurious emissions	less than 60 dB with respect to carrier
Harmonics	less than 60 dB
Microphone sensitivity	5 mV rms
Receiver	
Sensitivity	0.5 μV into 50 Ω for 12-dB Sinad; typically 0.4 μV
Selectivity	better than 60 dB at ±25 kHz
Audio power	1 W at 1% THD into 8 Ω
Frequency response	6 dB/octave rolloff above 1 kHz

Transmitter Operation

The transmitter is controlled by the press-to-talk switch on the microphone and this controls the various supply rails, as mentioned before. We'll come back to that. The signal from the microphone is fed to the preamplifier (Q13 and Q14) which provides substantial gain. The amplified signal is fed via C52 to a diode limiting circuit (D9 and D10) which prevents the following stages from being overloaded.

The signal from D10 is fed to Q15, a two-pole active-filter stage with unity gain. The output of this stage is the modulating signal which is applied from trimpot VR61 to varicap diode D11 via R62, C57, and R64. D11 is in the tank circuit of the vco (Q16) and thus is able to frequency modulate the vco according to the microphone-signal voltage.

The vco is a conventional grounded-gate oscillator using an N-channel FET. It oscillates at a nominal 146 MHz (center of band) as set by L8 and C64. Varicap D12 sets the vco to the exact frequency required, as controlled by the frequency synthesizer.

The main vco output signal is taken from its source and fed to Q17 and Q18, which are transformer coupled, and thence to Q19 and Q20, which are more or less conventional common-emitter amplifier stages. Q21 and Q22, on the other hand, are class-C power-amplifier stages which operate without forward bias at their bases.

By way of explanation, in a class-C amplifier such as Q22, the collector current flows for substantially less than every alternate half cycle with the tuned circuit preventing the generation of harmonics. In effect, a class-C amplifier tank circuit can be considered as the analog of a flywheel which has a short burst of energy applied to it during every cycle. It is a highly efficient amplifier.

The output power from Q22 is coupled to the antenna filter circuit mentioned previously. The path is via L26, L27, L29, and L30 to the output socket. A measure of the transmitter output is provided as follows: Gimmick capacitor C169 (two wires twisted together) feeds a small portion of the transmitter output to D14, which rectifies the signal and applies the resultant dc to the signal meter via R109 and filter capacitor C134.

Frequency Synthesis

The method of frequency synthesis is essentially a variation on the conventional phase-locked-loop (PLL) circuit. A PLL normally is composed of a voltage-controlled oscillator (vco), a reference oscillator, a programmable frequency divider (fed by the vco), and a phase comparator which compares the frequency-divided output of the vco with the reference oscillator.

For a VHF transceiver it is usual to have three oscillators: a vco, a reference oscillator, and an offset oscillator. In this case, the vco is Q16, the reference oscillator is associated with IC6, and the offset oscillator is Q26. IC5 is the phase comparator and IC4 is the programmable divider.

Let's start by looking at IC6. This IC is a combined oscillator and divider with a division ratio of 1024. It drives crystal X2 at a frequency of 10.24 MHz, which when divided by 1024 produces a reference frequency of 10 kHz at pin 7.

IC5, the phase comparator, compares the 10-kHz reference frequency from IC6 against the 10-kHz output from the programmable frequency divider, IC4. The output at pin 3 of IC5 is the PLL error voltage, which is a series of pulses. These are filtered to produce smooth dc by R91, C156, R87, R86, and C153. This dc error voltage is then applied to D12 in the vco (Q16) to maintain control over the vco output.

As shown on the circuit, when the PLL is in the lock condition and the vco output is 144 MHz, then the error voltage at TP3 is 2.7 volts dc (after setting up.)

Where the frequency-synthesizer circuit diverges from normal PLL practice is that the programmable divider does not merely "divide down" the output of the vco. Instead, IC4 divides the difference between the vco output and the third harmonic of the offset oscillator.

The reason for this indirect procedure is that it is not possible to easily provide for programmable division directly from 144 MHz.

What happens is this. The offset oscillator, Q26, operates at 44.234966 MHz in receive mode and at 47.801666 MHz in transmit mode. The relevant crystals, X4 and X3, are switched into circuit by diode D23 or D22.

The collector output circuit of Q26 is tuned to the third harmonic of these frequencies, i.e., 132.704898 MHz and 143.404998 MHz.

Depending on whether the transceiver is in receive or transmit mode, one or the other of these offset frequencies will be subtracted from the vco output frequency by the offset mixer, Q27. The difference frequency will range from 595 kHz (e.g., 144–143.405) to 4.595 MHz (148–143.405).

It is this range of differ-

ence frequencies which is applied to the programmable frequency divider, IC4, via Q28 and Q29.

So IC4 is programmed by the thumbwheel switches to divide the relevant difference frequency from Q27 to provide a 10-kHz output which is applied to the phase comparator, IC5.

Note, by the way, that the difference between the transmit and receive offset frequencies is 10.7 MHz, which is the required intermediate frequency.

So far, so good. But now we have to backtrack a little. There is a problem in that IC4 cannot precisely divide frequencies that are not an exact multiple of 10 kHz. Therefore, that example of 595 kHz (the lowest difference frequency) is not valid. And in fact, those offset oscillator frequencies given above are not quite correct.

Because of the provision for 5-kHz channel spacing, the offset oscillator crystals are in fact 1666 Hz too high. When the third harmonic of each crystal is considered, it will be 5 kHz high. So in normal operation, the crystals are pulled low by L14 and L15 for X4, and L16 and L17 for X3. So the normal offset transmit frequency is 47.8 MHz (143.4-MHz 3rd harmonic) and the offset receive frequency is 44.2333 MHz (3rd harmonic is 132.7 MHz).

When these offset frequencies are subtracted from the vco, the range of difference frequencies will be 600 kHz to 4.6 MHz. And note that 600 kHz is an exact multiple of 10 kHz.

When the +5-kHz facility is switched on, L15 and L17 are switched out of circuit by diodes D24 and D25 so that now the crystals do run 1666 Hz high and so the vco frequency is shifted up by 5 kHz.

Band Protection

Note that when the 10-kHz outputs of IC6 and IC4 (the programmable divider) are locked together, IC5 turns on Q30. This turns on Q18 and Q19 and thus allows the transmitter to operate. Thus the transmitter is prevented from producing signals which are outside the 144-to-148-MHz band.

But what about that +5-kHz offset we have just discussed? When that is applied, it would be possible for the vco to operate at 148.005 MHz and still produce a lock condition. The circuit design takes care of this possibility, too, since the thumbwheels are wired to only permit a maximum vco frequency of 147.99 MHz. When the 5 kHz is added, this gives a maximum vco frequency of 147.995 MHz, which is still inside the band limits.

Strictly speaking then, this means that only 399 channels are available with 10-kHz spacing and 798 channels with 5-kHz spacing (144.005 to 147.995 MHz).

±600-kHz Offset

Yet another factor has to be taken care of by the frequency-synthesizer circuitry. For repeater operation, the transmitter frequency usually has to be offset by minus 600 kHz from the receive frequency. Less often, it may have to be changed by plus 600 kHz. This condition could be met by adding more crystals to the offset oscillator circuitry, but in this circuit it has been achieved digitally.

As well as avoiding the expense of extra crystals, the digital method of offset does not require any alignment. IC2 and IC3 are digital adders. They add a code of 60 or 120 to the code applied by IC4. In the normal simplex mode, the addition of the 60 code is the standard. For −600-kHz repeater operation, this code is removed (controlled by D18 and IC2).

For +600-kHz operation, IC2 and IC3 are brought into play by D29 and D27 to add a code of 120 to IC4.

A neat advantage of this scheme is that it allows the "anti-repeater" operation whereby the receiver only can be shifted by ±600 kHz. This is achieved by the pushbutton in conjunction with Q23, Q24, and associated diodes. The advantage of the anti-repeater function is that it allows the operator to listen directly to his contact instead of via the repeater.

Note that when the 600-kHz offset facility is in use, the out-of-band protection circuitry does not prevent transmission outside the band limits. In this case it is up to the operator to make sure he or she does not transgress.

Power Supply

A +10-V regulated supply derived from Q1, Q2, and D2 supplies power to the vco, offset oscillator, frequency-synthesizer circuitry, and mix-down amplifier (Q28 and Q29). The +10-V regulated rail is also switched to various other sections of the circuit by Q4 and Q5, depending on whether the transceiver is in the receive or transmit mode.

When in the receive mode, the press-to-talk switch is open and D3, D4, and D5 cannot conduct. Therefore, Q4 supplies the +10-V receive rail. When the PTT switch is closed for transmit mode, D3 and D4 conduct, turning off Q4 and turning on Q5 to supply the +10-V transmit rail. D5 also conducts, turning on Q3 to supply the +12-V transmit rail.

The final two stages of the rf power amplifier, Q21 and Q22, are powered directly from the 13.8-V (battery) supply as is the audio amplifier. This is OK since Q21 and Q22 are normally biased off and can only operate when Q19 and Q20 are turned on by the +12-V transmit rail.

In Part II of this article, the construction and alignment of the DSE Commander will be detailed. ■

Harmonic-Free QRP?

Avoid an FCC pink slip by measuring second-harmonic power with the ZS6UP reactance load.

Mike van der Westhuizen ZS6UP
PO Box 13947
Sinoville
Pretoria 0129
South Africa

Like many others who like to keep their hands busy and who like the smell of solder, I also pass my time by building simple receivers[1] and QRP transmitters. I am always worried that the output filter of the QRP transmitter is not working well and that I put out too much second-harmonic power. It is no use listening to the second harmonic on the station receiver—it always sounds strong and no real idea can be formed of the strength in relation to the primary emission.

Of course, like most other hams, I don't own a spectrum analyzer to determine the harmonic output, but through the years I developed first a simple relative method and then a somewhat more sophisticated method of determining second-harmonic power. Of course, there are higher harmonics also, but in this discussion I shall stick to the second harmonic. In this article, I concentrate on 40m power from an 80m QRP transmitter.

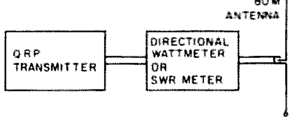


Fig. 1. QRP transmitter hooked through directional wattmeter or swr meter to 80m antenna.

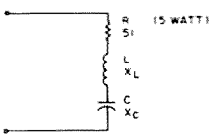


Fig. 2. Special dummy load.

Simple Relative Method

I know that on my 80m antenna there is a frequency spot where the swr is exactly 1:1. So, when I finish building a QRP transmitter, I tune it to this frequency and hook it through a directional wattmeter (a simple swr meter will also do) to the 80m antenna (see Fig. 1). As the swr is 1:1 on 80m, there will be no reflected power on 80m. All the reflected power is thus on 40m or higher frequencies.

All that I then do is to tune the output stage and filter of the QRP transmitter so that this reflected power is at a minimum. Then I check the forward power again to see if it hasn't dropped too much. After this I am pretty certain that almost all of the power going out is on 80m.

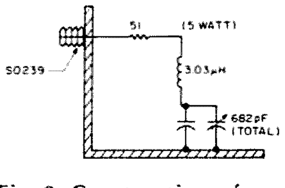


Fig. 3. Construction of special dummy load.

More Sophisticated Method

In the first-mentioned method, no idea can be formed of the ratio of 80m to 40m power, but it can be calculated if the swr on 40m on the 80m antenna is known exactly. (Somehow it doesn't appeal to me to put all these signals on the air for testing purposes only, even if I announce my callsign every time.) So I started thinking of a type of dummy load which has an swr equaling one on 80m and a much higher (but known) swr on 40m. Such a dummy load is shown in Fig. 2.

In Fig. 2, the 51-Ohm resistance, R, has more or less the same value as the impedance of 52-Ohm coaxial cable (Z_0). On 80m, $X_L = X_C$ and thus cancel out where X_L = inductive reactance of inductor L (Ohm) and X_C = capacitance reactance of capacitor C (Ohm).

On 40m, $X_L \neq X_C$, which causes a certain swr on 40m. See box for theoretical calculations.

In practice, we choose $R = Z_0$ and for 80: $X_L = X_C$. If these values are put in Equation 4, the swr = 1, as it should. If for 40m X_L is not equal to X_C, the swr is a value greater than one. We can now either choose a value for the swr and calculate $X_L - X_C$ or choose a value for $X_L - X_C$ and calculate the swr on 40m.

I chose the latter route and put $X_{L40} - X_{C40} = 100$, where the subscript 40 means 40m and later on the subscript 80 will mean 80m. Put in Equation 4, we get $swr_{40} = 5.83$.

So, if we now know the swr on 40m how can we apply it to find E_f on 40? From Equation 3 we can write Equation 5: $E_{f40} = [E_{r40}(swr_{40} + 1)^2]/(swr_{40} - 1)^2$. We also know that as $swr_{80} = 1$, there is no reflected power on 80m. So all the reflected power is due to 40m (or higher) harmonics. Total forward power E_{ft} is equal to $E_{f80} + E_{f40}$. For the measurement and calculation of E_{f40}/E_{f80}, we go about as follows:

Put the directional wattmeter in the line between the transmitter and the special dummy load. Read the forward power, which is $E_{ft} = E_{f80} + E_{f40}$. Read the reflected power, which is equal to E_{r40}. From the above equation, calculate E_{f40}. Then $E_{f80} = E_{ft} - E_{f40}$, and the ratio E_{f80} to E_{f40} can be calculated. An example later on will make it clearer.

To calculate values of L and C in Fig. 2, we can write the following equations: $X_{L40} - X_{C40} = 100$ (chosen value); $X_{L80} - X_{C80} = 0$. Thus, for 40m: $2\pi \times 7 \times 10^6 \times L \times 10^{-6} - 1/(2\pi \times 7 \times 10 \times C \times 10^{-12}) = 100$, and for 80m:

$2\pi \times 3.5 \times 10^6 \times L \times 10^{-6} - 1/(2\pi \times 3.5 \times 10 \times C \times 10^{-12}) = 0$.

Here we have two equations with two unknowns, and from simple arithmetic we get L = 3.03 microhenrys (μH), and C = 682 picofarads (pF).

(By the way, we don't need the actual X values, but here they are as a point of interest: $X_{L80} = X_{C80} = 66.6$ Ohms, $X_{L40} = 133.3$ Ohms, and $X_{C40} = 33.3$ Ohms.)

Construction

Construction is very, very simple. Using the well known formula for coils (in all handbooks), I wound a coil, L, with value 3.03 μH. For the capacitor, C, I put 470 μF in parallel with a variable, connected it to my capacitance meter, and turned the variable until total capacitance was 682 pF. If you don't have a capacitance meter, just put a few capacitors in parallel to get 682 pF. For resistor R use 51 Ohms. (47 or 56 Ohms will also do; 5 Watts; carbon.) Put the items together as in Fig. 3.

To test the contraption, I tuned my station transceiver to as low an output as possible. I switched to 3.5 MHz and connected it to the special dummy load through the directional wattmeter/swr meter. The swr was exactly 1.0. Then I tuned to 7 MHz, and lo and behold, the swr read 6.0, very near to the theoretical value of 5.83. I began to get the feeling that this thing was going to work!

Application

After the test, I removed the station transceiver and hooked on my latest 80m QRP transmitter. The directional wattmeter read: forward power, 22 Watts. Thus, $E_{ft} = E_{f80} + E_{f40} = 22$ Watts. I switched to reflected power, and the meter read 1 Watt.

Thus, $E_{r40} = 1$ Watt; from Equation 5: $E_{f40} = [1 \times (5.83 + 1)^2]/(5.83 - 1)^2 = 2.0$ Watts.

Thus, $E_{f80} = E_{ft} - E_{f40} = 22 - 2 = 20$ Watts; $E_{f80}/E_{f40} = 20/2 = 10 = 10$ dB.

Thus, the 40m signal is only 10 dB lower than the 80m signal. This is not good enough, and I now know I'll have to work again on the output stage and low-pass filter of my QRP transmitter.

Conclusion

I have described a method and simple device with which one can ascertain the second harmonic power of a home-built transmitter. I am sure that with a little thinking it can be extended to measure the higher harmonics, also. Is there an ingenious reader who will attempt this, without nearing the complexities of a real spectrum analyzer? ■

THEORY

Here are some equations for the calculation of swr—see reference 2.

(1) Swr = $(1 + p)/(1 - p)$, where p = reflection coefficient; and

(2) $p = \sqrt{E_r}/\sqrt{E_f}$, where E_f = forward power (Watt) and E_r = reflected power (Watt).

(3) Thus swr = $(\sqrt{E_f} + \sqrt{E_r})/(\sqrt{E_f} - \sqrt{E_r})$.

In terms of impedances, the complete equation for swr is

(4) Swr = $(\sqrt{(R + Z)^2 + (X_L - X_c)^2} + \sqrt{(R - Z_o)^2 + (X_L - X_c)^2})$ divided by $(\sqrt{(R + Z_o)^2 + (X_L - X_c)^2} - \sqrt{(R - Z_o)^2 + (X_L - X_c)^2})$.

(5) $E_{f40} = [E_{r40}(swr_{40} + 1)^2]/(swr_{40} - 1)^2$.

References

1 "Direct Conversion Lives," Mike van der Westhuizen ZS6UP, *73 Magazine*, November, 1980.

2 *ARRL Antenna Book*, American Radio Relay League, Newington, Connecticut.

World War Wireless

What can you do with a pencil, a razor blade, a paper clip, and a hank of wire? Why, build a radio, of course!

Penn Clower W1BC
459 Lowell Street
Andover MA 01810

Hams with TVI problems often leam the hard way how poor metal connections can generate harmonics. Two conductors making partial contact, in gutters for example, can rectify and re-radiate as harmonics part of the signal from a nearby transmitter. What few newer hams realize is that the same phenomenon was crucial to the operation of one of the cheapest receivers ever designed: the Foxhole radio.

Photos by W1GSL

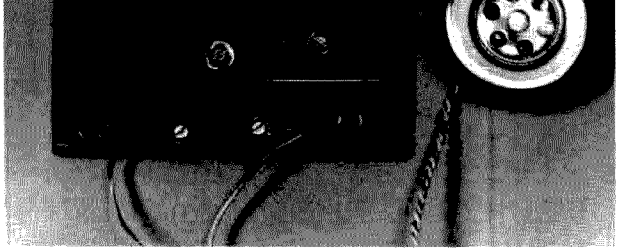


Photo A. A close replica of a set W8EFW described in 1945, this Foxhole radio can be built for pennies and works amazingly well. The razor blade is the diode. The earphone was borrowed from a telephone.

The phrase "hurry up and wait" probably predates World War II, but its meaning was certainly driven home then to thousands of hams. Often serving long tours of duty in forgettable places, ham GIs gave top priority to receiving news and entertainment from the nearby Armed Forces Radio Station. Of course, in those days radios used tubes, so the bulk and power requirements of typical receivers limited their availability. This was especially true in forward locations where the Army had more important services to provide—things like food and ammunition.

So some genius, and we can only hope he was a ham, invented the Foxhole radio. Made from commonly available components, its chief distinguishing feature was the use of a razor blade for the detector diode. A flat coil of enameled wire and a headset (probably "borrowed" from a field telephone) completed the circuit. While not an outstanding performer, the radio was compact, obtainable, and best of all—it worked! Copies were built and used all over the world.

The original design has several interesting features in addition to the razor-blade detector. Note the absence of a tuning capacitor in Fig. 1(a). The sliding contact on the coil doesn't tune stations so much as it adjusts the match between the antenna and its load. There might be some tuning action if the antenna looks capacitive, but selectivity is sure to be poor. My guess is that it didn't matter because there was probably only one station to listen to anyway.

Puzzled about the wide, flat coil form shown in the photographs? Everyone knows a good efficient inductor is wound as a cylinder no more than two diameters long. The flat coil may be an electrical compromise, but it sure is a lot easier to pack in a knapsack, put in a pocket, or hide in a POW camp.

All in all, the Foxhole receiver is real ham-radio stuff. You scrounge the parts, put them together as

best you can, and the result works!

Building the Foxhole radio today is as easy as it was in WWII. The set shown in Photo A is the real thing—a close copy of the receiver described by W8EFW in the *QST* "Hints and Kinks" column for September, 1945. To improve performance, I also built the several accessories shown in Photo B. The biggest gain came from using a capacitor to resonate the coil. In keeping with the spirit of the project, even that component was homemade—with plates snipped from the side of an old tin can.

A Razor-Sharp Detector

The razor-blade detector is the most interesting part of the receiver. To build it, you first need a Gillette Super Blue Blade. Forget about using anything made of platinum or coated with Teflon™. To simulate wartime conditions, I used my blade for its intended purpose until it hurt—about three weeks. That may not be necessary, but I wanted to do things right and my wife wouldn't let me dig a foxhole in the backyard. Compromises are sometimes unavoidable.

I clamped the used blade to the baseplate with a short woodscrew (W8EFW recommended thumb or carpet tacks). The same mounting screw clamps the contact wire to the blade, so I scraped away some of the bluing to ensure a good contact.

The rectifier contact point is made from a 1" piece of pencil lead. Start by sharpening a pencil, then carefully carve away the wood at the tip. Break off the sharpened length of lead and tightly wrap its blunted end with 8 or 9 turns of fairly stiff wire. Leave a 1" or 2" pigtail of wire to clamp under the "phone jack" terminal screw when you mount the rectifier.

In operation, the point of the lead is moved over the surface of the razor blade until a sensitive spot is found. When that happens, the radio starts to work and the lead is carefully released so that its mounting wire holds it in the correct position. I found rectification was best when the point contact was resting on one of the silver letters etched into the blade. Of course, it goes without saying that the blade is thoroughly cleared of soap or oil before rectification is attempted. This is a crude system and a little tricky to adjust, but once set up, it works surprisingly well.

Scrap Wood Chassis

Construction of the rest of the radio is shown pretty clearly in the photographs. The baseplate is a 4" by 4" square of 3/8" or 1/4" wood. The coil is about 175 turns of #26 enameled wire wound on another scrap of the same wood, this one 2" by 4". Any wire size from 22 to 28 will work as long as the wire is enameled to keep the turns from shorting. The antenna, ground, and headphone terminals are made from paper clips. The sliding coil contact is a paper clip bent and mounted to maintain downward pressure on the coil. I soldered the pivot end of this arm to a washer and fastened that to the board with a screw. W8EFW simply bent the end of the paper clip around a tack. Running the arm back and forth across the coil several times makes enough of a mark to show where the insulation must be scraped away for the arm to make contact. I also soldered all the wire connections to improve reliability. The radio will work without that step, but it does make life a little easier.

It goes without saying that this radio, like its brother, the crystal set, needs a good antenna and ground. The easiest thing to use for a

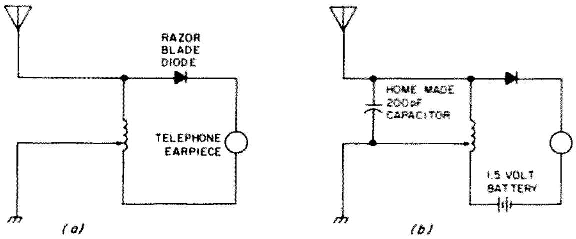


Fig. 1. Complete schematic of the Foxhole radio. The original circuit (a) was built by GIs all over the world during WWII. The addition (b) of a tuning capacitor and a dry cell (to bias the detector) improves reception.

ground is the screw holding the cover plate to a standard ac outlet. If it's available (and made of copper), the house water supply may make a better ground. An acceptable antenna can be made from 50 feet of wire routed out a window and away from the house. Keep the far end as high as possible and use more wire if you can. As far as this radio is concerned, there can never be too much antenna!

This set works best if the old-style high-impedance headphones are used. The new, low-impedance hi-fi types would work only with a matching transformer. If the proper phones aren't available, you can always do what the GIs probably did—borrow the earpiece from a telephone handset. The Ma Bell earpiece shown in the photographs has a dc resistance of 6 Ohms and an ac impedance of about 150

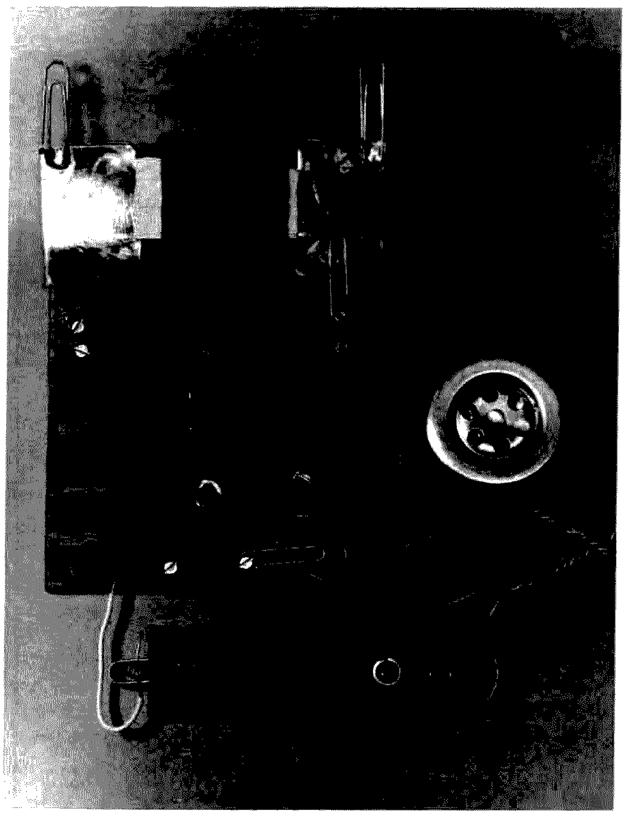


Photo B. Never content to leave well enough alone, the progressive amateur will be looking for high-performance modifications. Here are two: The homemade tuning capacitor and detector bias pack will boost both selectivity and sensitivity.

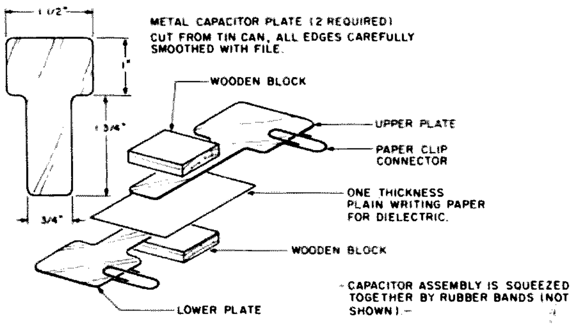


Fig. 2. Home-brew 250-pF (more or less) capacitor.

Ohms. It works almost as well as real headphones.

Operation

There's certainly nothing sophisticated about tuning the Foxhole radio. Check the wiring, hook up the antenna and ground, and connect the earphones. Set the slider to the middle of the coil and start listening. Move the point of the pencil lead slowly across the lettering on the razor blade until you hear a station. Try several different spots because some will work better than others. As a final step, move the slider across the coil until the signal strength is maximized.

The performance of the Foxhole radio will depend on your skill in adjusting the detector and the efficiency of your antenna. W8EFW claimed a range of 25 miles with a good antenna and ground. At my location, two nearby stations (about 5 to 7 miles away) dominate the set so I can't hear anything further away. Those local stations are quite clear, though, and come in with reasonable volume.

DX Accessories

There are several ways to improve the performance of this little radio, and luckily they're both cheap and easy. The first thing to add is a capacitor for resonating the coil, as shown in Fig. 1(b) and Photo B. With my antenna, that gave a noticeable boost to headphone volume and also let me separate the local stations. My friend W1GSL found that at his QTH the capacitor worked best when it was in series with the antenna. The capacitor always improved reception, though, so it's certainly a worthwhile addition.

An old 365-pF broadcast variable is perfect for the job, but you'd be cheating to use one. It's more sporting to make your own capacitor with plates cut from a tin can.

First cut (very *carefully*, those edges are sharp!) a pair of T-shaped plates, as shown in Fig. 2. Smooth the edges with a file and solder on two paper clips as shown. These two plates, separated slightly by an insulator, will be clamped together between wooden blocks to make a fixed 200-pF capacitor. That unit can then ride piggyback on the set, as shown in Photo B.

At first I tried using cellophane tape for the dielectric. That had a lot of dc leakage, so plain writing paper was used in the final version. One layer of paper between the plates makes a nice capacitor and gives about 100 pF per square inch of plate area. Any capacitance value between 150 and 350 pF will work, and the final value can be adjusted if necessary by sliding the plates to change the amount of overlap.

The other circuit improvement is the addition of a 1.5-volt battery to bias the detector further into its nonlinear region. What? A "crystal" set with a battery? The idea may seem strange now, but in the early days of radio that technique was quite common and, in fact, necessary with some of the crystal materials used. Current drain is only one or two mA, so battery life shouldn't be a problem.

The battery holder shown in Photo B matches the style of the rest of the "equipment" and is also easy to make. When using the battery, you may find it easier to adjust the detector first and then add the battery bias for a boost in signal strength. The battery simply goes in series with the headphones. Try flipping the battery polarity several times, as one direction may work better than the other.

Conclusions

The Foxhole radio is cheap to build and fun to operate, but it certainly isn't the world's best "crystal" set and you won't spend hours listening to it. Amazingly, though, it does work, and its story is a truly fascinating bit of radio history. More than just a history lesson, however, this project will also leave you with two long-term benefits.

First, it gives you a perfect way to win "sucker bets" with friends who don't believe you can build a working radio using household materials and no commercial tubes, transistors, or diodes.

Second, you'll have a lot more respect for the rectifying properties of imperfect connections. That's helpful in those cases of harmonic-type TVI which occur despite the use of a properly adjusted transmitter and a good low-pass filter. Rectification generates harmonics, but when searching for the diode, it sure is easy for the inexperienced ham to overlook the rusty joints in his neighbor's TV mast! ■

Instant ATV!

W8CHK breaks through the mystique surrounding fast-scan television. You won't believe how easy it can be!

Alan Smith W8CHK
6275 King Arthur Drive
Swartz Creek MI 48473

Photo A. Camera with transmitter in a Hammond #1590D housing. Also shown is the thirteen-inch ground-plane disc needed with most cameras for an rf shield. (Photo by P.C. Electronics)

The present generation has seen home television grow from a sprouting of folded dipoles on rooftops and seven-inch viewing screens to a wonderful array of hi-tech toys. At the present time, hardly a household, cottage, or mansion in any corner of the land is considered livable without at least two TV sets.

As video literacy increases, so does hardware awareness. This raised consciousness soon starts to lobby for a video recorder. After that, a camera becomes almost mandatory. Sound familiar?

Video recorder/camera combinations open a world of creativity undreamed of by any hacker (to borrow a term) previously limited to using a movie camera with its problems of film editing and projection. Now even one of the major photography magazines is talking about the "video explosion." This is great stuff and apparently there is a separate subculture growing rapidly out of these new mass-market technologies. There is a large area of opportunity available, however, for individual and personal creative video work which remains largely untouched. This is ATV: amateur television.

Broadly speaking, this aspect of television will remain untouched because it is absolutely illegal to be active in it without an appropriate license. Most readers, however, will know that A5 emission (video) is perfectly legal for any holder of a Technician-level or higher amateur license with privileges above 420 MHz. But of the large number of amateurs qualified for operating in these bands, only a relative few work with ATV. It is estimated that fewer than 3,500 are active in traditional fast-scan amateur television.

Admittedly, this mode has been slow in developing for a variety of reasons. In the less populous areas even today, your pix may go out to the world in great style. But you may have a long wait for someone to come back to your call.

Until recently, a lack of inexpensive appliance hardware for the job was a major obstacle. And, of course, the "strangeness" of video electronics probably continues to intimidate a lot of folk. But given the type of mind associated with amateur radio, intimidation has got to be a poor excuse. Consider the evidence. Personal com-

puters, for example, are being welcomed into the shacks with open arms and creative understanding. And the few on the cutting edge who have mixed ATV and computer graphics have come to know the true meaning of remote screen.

ATV is in line to benefit greatly from an outpouring of mass-market video hardware. It has flooded retail stores everywhere. Seventy centimeters in particular could be on the verge of new popularity as one result of this windfall.

An easy way to get into video on this band or to build on an existing base is via the P.C. Electronics one-Watt video transmitter which is sold as a wired and tested PC board module (sales limited to holders of Technician- or higher-class licenses). You will find this video transmitter to be a very high-quality unit. It is also a perfect natural for ham use. At this writing, it has no equal in performance, ease of packaging, and general utility in its price range. Its relatively low cost derives in part from the need for the buyer to personalize the case and design the control placement.

The P.C. Electronics board is fully populated, factory aligned, and tested. In fact, you can give it a performance check on your own bench rather quickly. The full utility of the KPA5 transmitter package, however, doesn't surface until it is configured for truly portable/mobile operation—which leads us to the object of this article.

About the only power tool needed to prepare a housing is a 1/4-inch or larger electric drill. This is necessary to drill a variety of holes.

What you pay P.C. Electronics for is a neat little circuit board about 3-1/16" × 3-3/4" which is tightly packed with all the necessary goodies. This video transmitter will accept composite video and audio from a camera, videotape recorder, or computer. And there is a separate input line for a low-Z mike. The board comes supplied with four mounting holes for #4-40 × 1/2" screws.

It can be ordered with two switchable crystal-controlled frequencies of your choice. You specify what you want between 421.25 and 439.25; 439.25 is the commonly-used calling frequency in the eastern states and midwest, and 434.00 is the frequency of choice for the west (second crystal extra at fifteen dollars).

Normally, no adjustments are needed on the board as received from the factory. However, only a voltmeter is required for realignment if the need arises. Instructions for this procedure are provided with each video board purchase, together with a complete circuit diagram and setup instructions. (*A5 Magazine* for April, 1984, carries a full-page spread of the schematic.)

Now, as mobility and portability figure in all of the hot applications for this mighty mite, the housing must be very sturdy. There are several options and you may have one in mind which is just right for you. However, if your plans include joining camera and transmitter into a single-unit shoulder mount and you want the smallest possible package, the Hammond #1590C die-cast aluminum box is a good choice. At 4.3" × 3.6" × 2.2", it is just large enough to house the board and connector ports.

You may want to consider a larger one, as illustrated in Photo A, however. Shown here is a camera with a transmitter installed in the larger, Hammond #1590D housing. Also shown is the thirteen-inch ground-plane disc that is needed with most cameras for an rf shield in this close-coupled assembly.

It should be noted here that the original KPA5 design purpose ("visual" parade-control communications) required the smallest possible package. Some of the spin-off applications also demand an ultra-compact package. But there are general-purpose uses which can benefit from a slightly larger housing and at the same time not rule out the original design purpose.

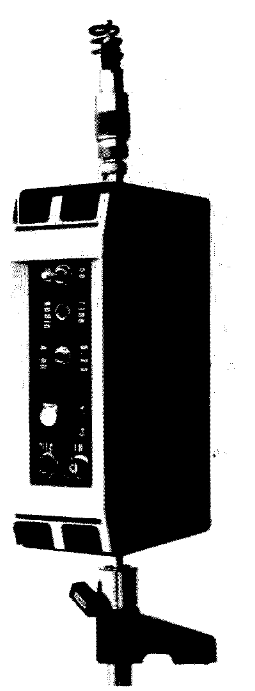


Photo B. The ready-to-use 1-Watt video transmitter supported by a tabletop photographic tripod. The optional bezel is described in the text.

As we had a broad base of application in view, it was decided to start with a box size that would have enough

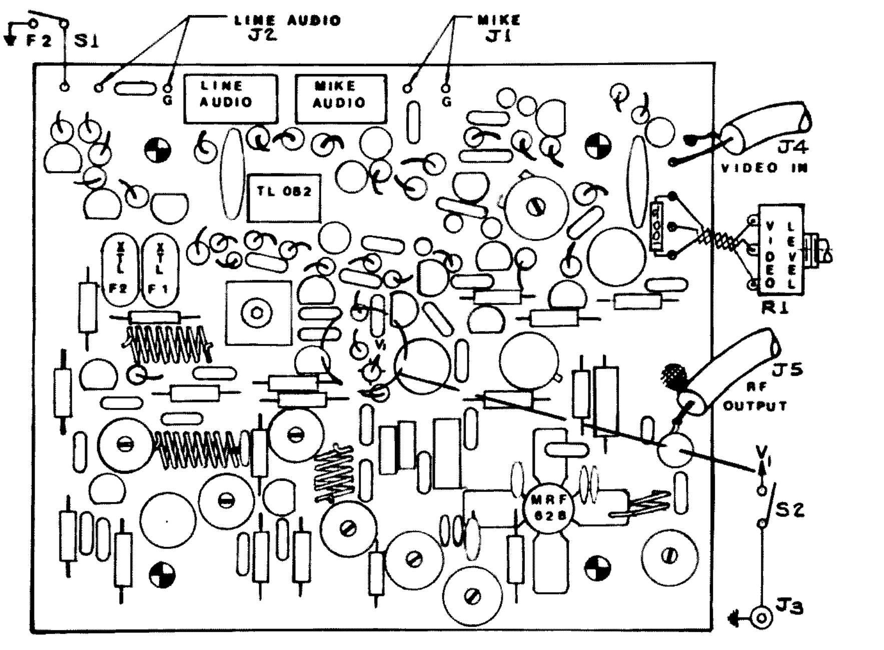


Fig. 1. General parts layout with control options labeled for use with a nonspecialized video connector. (Drawn to scale from P.C. Electronics material)

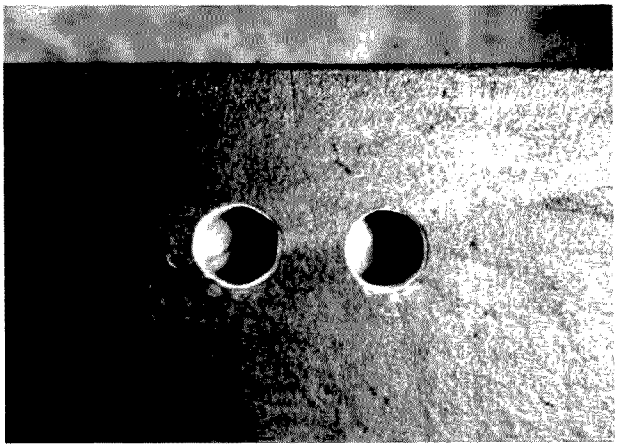


Photo C. Close-up of audio-adjustment access holes.

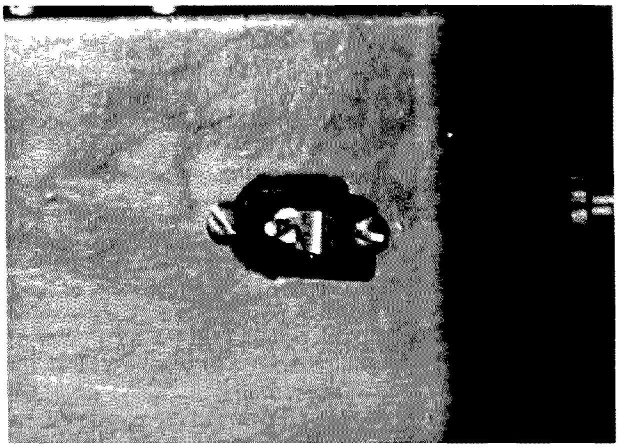


Photo D. Close-up of power-jack installation.

room for some external controls and perhaps future expansion.

This housing (Hammond Cat. #1590R), shown in Photo B, is 2.2″ × 4.3″ × 7.5″. There are several other sizes to choose from such as the Hammond #1590D (Photo A) or Bud CU247 in the die-cast line. The Hammond die-cast boxes are available in a gray hammertone at additional cost.

If you want to use a camera and transmitter as separates, a larger enclosure makes sense. The added room makes for easy control placement and it is possible to plan space for a small 12-volt battery pack. Although this feature was not made a part of our transmitter package, an integral battery will be easy to add and will be useful for tests and short events.

There are three basic options for control placement. The first is to keep the audio and video pots as they are on the board without change. This option may apply best when the small housing is used. The second option is to bring these pots outside for external control. (The board is drilled for these wires.) A third choice is to go with a combination, as shown in Fig. 2. The thought here is that only the most often used controls need to be brought out to the panel.

For example: The locations of the audio line and microphone pots on the board are suitable for adjustment with a screwdriver (Photo C), but since it is important to have quick access to the video-level control, this one should be brought to the outside. To do this, the video-level pot located on the board is removed and the panel-mounted pot (R1) is wired in. . . leads no longer than three inches, and twist them together, please!

The power input jack (12–14 V dc) is shown in Photo D.

A further selection must be made on the type of video input receptacle to be used. Basically, the choices are between a simple RCA or BNC connector as found on some VTRs and black-and-white cameras or a multi-pin mating socket for your specific camera. With this latter option, power, audio, and video connections are made through the single connector. An important concern is raised if this is the choice. Be certain that a matching socket is available for the connector on any camera you intend to buy. Although there is some standardization, it is not entirely reliable.

Fig. 1 shows a parts layout based on a nonspecialized video connector. Control options are labeled.

A standard 1/4-20 tripod socket (Photo E) mounted on the bottom of the case can provide a sturdy attachment point for a large variety of commonly available photographic hardware, such as tripods and clamps. It can also be used as part of a camera/transmitter bracket, if this option is planned.

So-called "parts cameras" are the best source for tripod sockets. Most camera repair shops can be helpful in this area if the old junk box is unproductive.

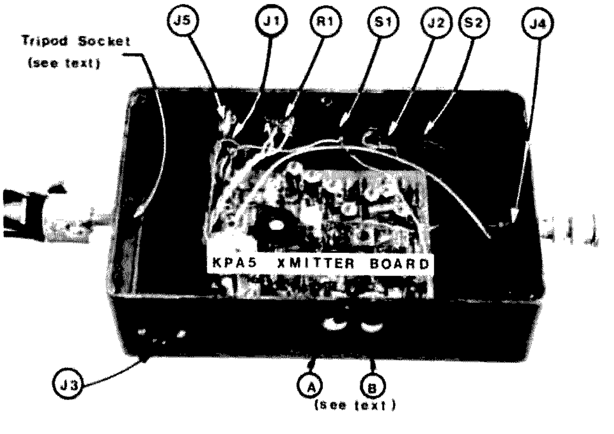


Fig. 2. A middle-of-the-road approach to packaging the transmitter board. Video-level control is brought out to the panel as are connector jacks and switches. Audio levels are screwdriver-adjusted through access holes A and B.

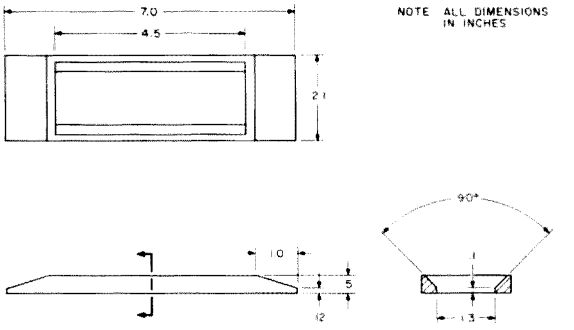


Fig. 3. Bezel dimensional drawing. This is an optional item which can be added at any time. Its basic purpose is to act as a switch guard, but it also improves the appearance.

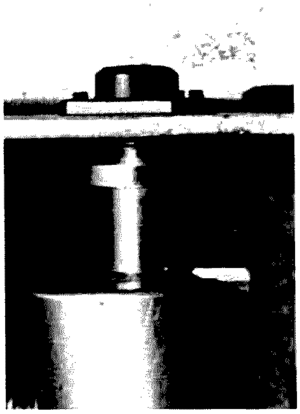


Photo E. Close-up of tripod-socket installation. See text for details.

Photo F. Panel layout. The bezel (see text) shields the switches from accidental tripping.

The 500-Ohm video-level pot (R1) must be shunted with a 100-Ohm resistor. A 100-Ohm pot is preferred for this spot but is hard to find (Fig. 1).

An antenna can be put together quite simply. First, a 6-1/2″ length of #22 rod is soldered to a BNC connector. Next, this is stabilized with an epoxy filler. Presto, a serviceable antenna! This simple whip can be expected to give good usable pictures at distances of up to a mile. A commercial antenna such as a Yaesu, part number YHA-44, or similar will also work well.

Where maximum mobility is not required or for use as part of a base station, an amplifier such as the Mirage D-24 will boost 1 Watt of video up to as high as 40 Watts. This amount of power generates a respectable signal, especially if working into a high-efficiency antenna such as a KLM 440-27.

It goes without saying that do-it-yourself projects tend to reflect the wants and wishes of the doer. This project is open to considerable variation. The bezel, for instance (Photos B and F and Fig. 3), makes an effective switch shield. But it can be eliminated or altered in a number of ways. The bezel, detailed in Fig. 3, can be cut from a piece of 1/2″-thick plastic. It also can be made from four pieces (or more) cemented together or even cut out of a piece of 1/2″ balsa. The bezel visible in Photo B is attached with industrial epoxy. A couple of screws would do as well.

As cameras follow the apparent destiny of all solid-state devices and continue to shrink in size, mobile video will be in a position to become as commonplace as FM hand-helds are today. You can have it now with a package not much larger than some of the HTs of just ten years ago. Applications in use at the present time include robot coordination, model-plane flying, model-boat sailing, and public service with parades, marathons, and other people-oriented events.

Some pioneer work has been done with weather watch, and walk-about video capability makes lots of expansion possible. In addition to these public-service opportunities, there is always plain old hamming to fall back on. That is sort of fun, too...but I suppose you know that. ■

Parts List

R1 500-Ohm carbon or cermet pot (see text); Circuit Specialists, cat. #31VA205
S1 SPST submini toggle (Radio Shack #275-324)
S2 SPST submini toggle (RS #275-324)
J1 Std. 1/4″ phone jack, 3-conductor (RS #274-312)
J2 Std. 1/8″ mini phone jack (RS #274-251)
J3 Coaxial power jack (RS #274-1565)
J4 Type UG1094 female BNC connector (RS #278-105)
J5 Type UG1094 female BNC connector (RS #278-105)
PL Coaxial power plug (J3 matching) (RS #274-1567)
Knob—For 1/4″ shaft (RS #274-407)
Bezel—(see text)

KPA5 Video Xmitter board with one crystal: $159.00
P.C. Electronics
2522 Paxson Ln.
Arcadia CA 91006

Housing—(see text)

Bud Econoboxes	Hammond Die-Cast Boxes
Shand Electronics	RadioKit
2401 Dort Highway	Box 411
Flint MI 48503	Greenville NH 03048

Circuit Specialists
PO Box 3047
Scottsdale AZ 85257

Antenna—(see text)

Modification Mania!

Here are not five, not ten, but fifteen ways to perk up your HW-101.

Wayne Arnett AI7C
3315 N. Apollo Drive
Chandler AZ 85224

When the Heathkit® HW series was first introduced, Hammarlund was still making receivers and most of the activity on two meters was AM simplex. It's tempting to think of the HW-101 and other tube-type gear as relics of another era. But Heath products tend to age gracefully, and the HW-101 is no exception.

Even though it's a little behind the times, this transceiver has a reputation for good performance at the right price. This article describes several modifications that make operating even more effective and enjoyable. Most of them are easy and inexpensive. These ideas can also be used in the other HW/SB series transceivers.

The Digital Debate

You can lead a normal life without digital frequency display, but only if you have a good analog dial. On the HW-101, it's miles between calibration points. This makes it very difficult to locate accurately subband borders that don't fall at 100-kHz intervals.

Newer radios use 25-kHz calibrators, and it's easy to build one into the HW-101. I copied the crystal calibrator in Heath's HR-1680 receiver and added a divide-by-four flip-flop IC to the output—see Fig. 1(a).

To install the new circuit, first disable the old V17B calibrator by removing R217, R218, C218, C219, and CR201 from the bandpass board. Leave the 100-kHz crystal in place, but isolate the foil patterns around its pins.

Recycle the 8-50-pF trimmer into the new calibrator and build the circuit on a small square of perfboard. Suspend the board on stiff wires soldered to the ground foil underneath V17. Then connect the crystal with short leads.

Unsolder the white wire at pin 3 of V17 and use it to bring 12 volts dc from the function switch to the new calibrator. Move the small coax cable from CR201 to the 25-kHz output. Finally, rearrange the function switch as shown in Fig. 1(b). The dc power supply needed for this and some other additions will be described later. The changes to lugs 5 and 6 of the function switch also are covered elsewhere.

A Sixth Band

Access to WWV will help you take full advantage of the new calibrator. At 15 MHz, WWV is close enough to the 20-meter ham band that only a new crystal in the heterodyne frequency oscillator (hfo) is needed to provide the additional coverage. Since 20 meters can't be sacrificed, a switching arrangement is used.

Instead of running long

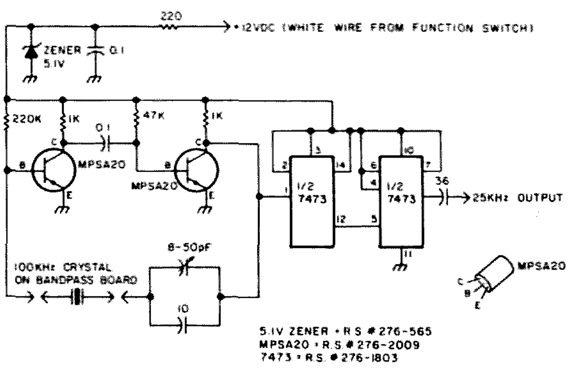


Fig. 1(a). 25-kHz crystal calibrator.

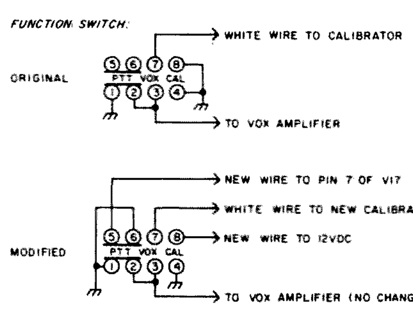


Fig. 1(b). Modified function switch.

wires from the hfo crystals to a distant switch, I decided to use a small relay, as shown in Fig. 2. The new 23.895-MHz crystal and relay were mounted on perfboard and attached to the center shield near the crystal board (see Photo D). The crystal is Heath part no. 404-279. A toggle switch on the rear panel controls the relay, which selects 20 meters or WWV when the bandswitch is at 14 MHz. The relay also grounds the WWV crystal when it's not in use.

To get the WWV assembly into the hfo circuit, make a cut in the crystal board foil between the switch wafer and 20-meter crystal (Y503). Then drill a small hole on each side of the cut, bring short leads forward to the relay, and connect as shown.

You shouldn't have to realign anything which might compromise 20-meter performance, although the hfo coil (L603) may need touching up if the new crystal won't oscillate. Avoid using a 23.395-MHz crystal for 14.5–15.0-MHz coverage because WWV then appears at 500 on the main dial. This results in a two-tone competition between WWV and the third vfo harmonic.

Since the transmitter is not disabled when tuning 15 MHz, a front-panel "reminder" LED should be included. Calling CQ on 15.175 is discouraged, and Radio Moscow doesn't count toward DXCC, anyway.

Receiver Incremental Tuning (RIT)

Even early CB rigs had clarifier controls, but for reasons known only to Heath, RIT has until recently been absent from their transceivers. Fortunately, an RIT circuit is easy to install, and several schemes have been published in the past.

Two circuits I've used successfully in my HW-101 were found in the Holiday, 1976, issue of *73* ("Add RIT to Your Transceiver," *73* Staff) and *QST* for October, 1974 ("Hints and Kinks," K4EQA).

However, I've noticed that most add-on RITs share a common deficiency. They have no on/off switch and depend on the operator's best guess to position a knob in just the right place. Ironically, this often results in off-frequency calls or "leapfrogging," which are the very problems we're trying to eliminate in the first place.

An on/off switch can be designed into an RIT by using a multi-turn trimpot and frequency counter to balance out the circuit's effects on the vfo when it's turned off. I found it simpler, though, to use a Protronics RIT kit. This includes a center-stop detent in the tuning control and a voltage-regulated zero point. This "click-stop" is just as good as an on/off switch and virtually eliminates off-frequency calling.

I have built three of the kits into different transceivers without any problems. They come with instructions and cost about $15.00. Get the details from Protronics, Inc., Box 778, Buckley WA 98321.

While you have the vfo assembly removed for an RIT modification, put a dab of caulk between C946 (the large 4700-pF disc) and the aluminum enclosure. This will hold it still and help prevent the vibration-caused microphonics common to some HW-101s.

Better CW Performance

When the HW-101 is properly tuned to an incoming CW signal, the beat note you hear is a rather high-pitched 1000 Hz. This departure from the current norm of something close to 750 Hz is tiresome to the ear. It's also not ideal for some audio filters and computer interface units. Slow-recovery agc is another strike against the serious CW operator.

I modified the mode switch to pad the USB/CW bfo crystal down by 250 Hz and to select fast agc when operating CW (refer to Fig. 3). By extending the mode-switch shaft to accommodate another wafer, two new switch sections are made available. Even after moving C15 and C26 to the foil side of the modulator circuit board, space is at a premium for the extended mode switch. Choose your new switch hardware carefully.

One section of the new wafer places padding capacitance across the bfo crystal which is adjusted for a more pleasing tone. The other section connects a trimpot in series with R117, the agc timing resistor. In my case, about 500k gives a "snappy" agc without popping on strong signals.

Since the 400-Hz CW filter is in the i-f stage, it is not affected by the lower bfo frequency. In other words, it will work just like it used to, except the signal that's centered in the filter's passband will appear at the speaker as a 750-Hz note. The transmitter offset will still be correct.

You're right if you think this isn't a ten-minute job. The same improvements can be made with a double-

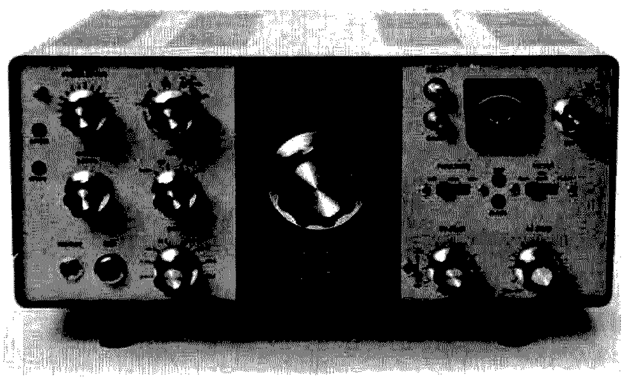


Photo A. The finished product with new controls, LED status indicators, and spinner knob.

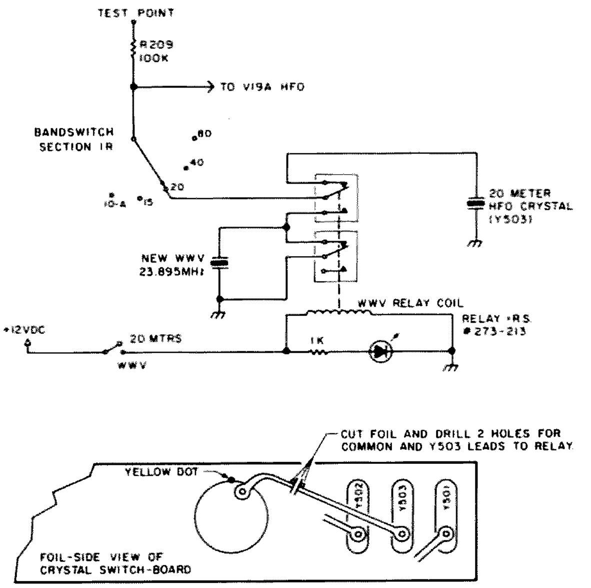


Fig. 2. Modification of hfo circuit for 15-MHz WWV reception.

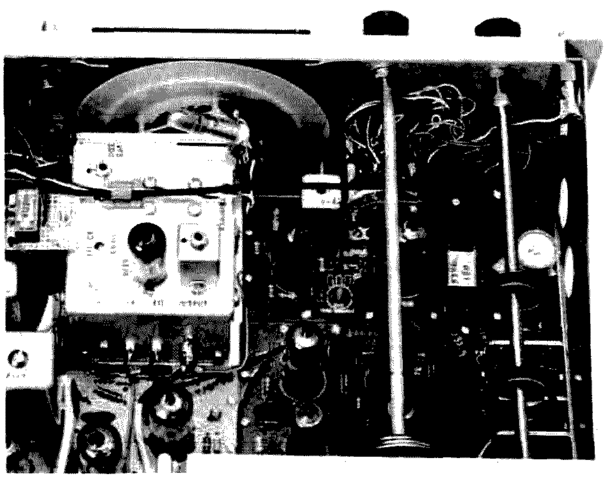


Photo B. Close-up of modified three-wafer mode switch. S-meter relay and front-panel VOX controls are visible at the far left.

pole toggle switch mounted near the bandswitch (again, see Fig. 3). This comes closer to being quick and easy, but it's less convenient since the toggle switch has to be remembered when changing between USB and CW. For me, the benefits were worth the trouble of rebuilding the mode switch.

Another problem for CW buffs with the stock HW-101 is not being able to check keyer speed without sending a signal. It is also impossible to manually control CW transmission, such as with a send/receive switch. As originally wired, the rig changes to transmit mode any time the key is tapped.

A minor change to the function switch allows manual T/R control while leaving sidetone operation intact. Note the new connections to lugs 5 and 6 in Fig. 1(b). With the switch in PTT position, the tone-generator output is grounded on its way to the VOX amplifier, which prevents the transmitter from being keyed. Now the sidetone is audible in receive mode, and the keyer can be adjusted without transmitting.

For semi-break-in operation, set the function switch to VOX. To manually activate the transmitter, connect a normally-open foot switch (or any other external T/R control) from point 16 on the bandpass board to ground. Set the function switch to PTT, and the VOX circuit is disabled.

Civilized Audio

Of all the HW-101's shortcomings, probably the one that most affects non-ham family members is the sidetone. It's earsplitting volume can't be tamed, and only the most considerate ham will consent to wear headphones.

I maintained domestic tranquility by duplicating the SB-102's sidetone volume control in my rig (see A in Fig. 4); put the 500k control on the rear panel and you easily can adjust the sidetone between silent and obnoxious.

The front-panel headphone jack is intended for high-impedance phones, which is quaint but not very practical. Adding a phone jack to the speaker cabinet is easy enough, but it's also a simple procedure to modify the front-panel jack for eight-Ohm phones (see B in Fig. 4).

Move the 100-Ohm resistor from the speaker phono socket to the audio transformer's green lead. Use shielded cable to carry eight-Ohm audio to the headphone jack, and back to the speaker socket.

With every microphone I've tried, full SSB output was possible only by running the mike gain open and shouting. In a previous article (*73*, October, 1981), K5SE described a mike preamp using tube V5B in the HW-101. This works very well, but I wanted to reserve V5B as a buffer for remote vfos. The circuit shown in C in Fig. 4 was adapted from one found in *The ARRL Handbook*, and seems to work just as well.

The preamp can be built on perfboard, but for this and other small circuits such as the 25-kHz calibrator, I prefer Radio Shack's experimenter boards (part no. 276-154). These boards will accommodate ICs and the DIP-type relays, and can easily be cut to size.

Drill mounting holes in the side rail near the microphone jack and suspend the board on spacers or washers. Use small hardware, #2 or #4, to prevent binding between the mounting screws

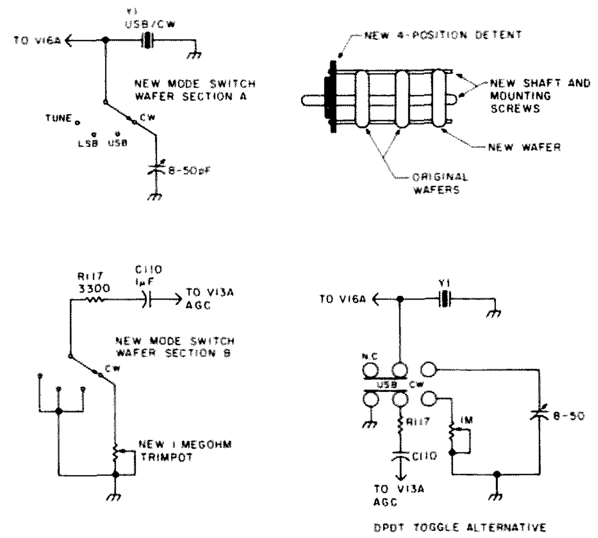


Fig. 3. Two methods of changing CW bfo frequency and obtaining fast/slow agc.

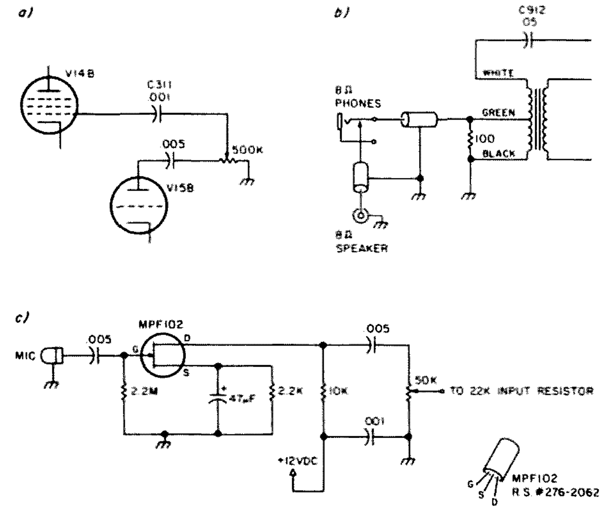


Fig. 4. The SB-102 sidetone level control is at A. At B, the audio transformer output is rewired for 8-Ohm output to speaker and phones. C shows a simple microphone preamplifier.

and the lower cabinet shell. Adjust the 50k trimpot for full modulation while speaking normally, with the HW-101's mike gain at about the ten o'clock position. I found that shielding was not required, but a bypass capacitor on the 12-volt line is recommended.

Crystal-Filter Selection

Many HW-101 owners have had problems with the crystal-filter switches and the linkage that operates them. The lever behind the rf-gain knob is prone to breaking, and the slide switches get dirty and show contact resistance after a period of time.

For a partial fix, you can loosen the rf-gain-control nut and then re-tighten it while pushing upward on the control. This helps reduce friction between the linkage lever and the lower chassis lip. The slide switches can be cleaned by removing the backs and shining the contacts. But you have to be careful doing this because the switches like to send springs and pieces flying in all directions when they're disassembled.

I chose a more permanent solution which eliminates the old switches and linkage altogether. A miniature relay and a DPDT toggle switch were substituted for the two slide switches, as shown in Fig. 5. One pole of the new toggle handles the output side of the filters, while the other pole controls the relay, which in turn handles the filter inputs.

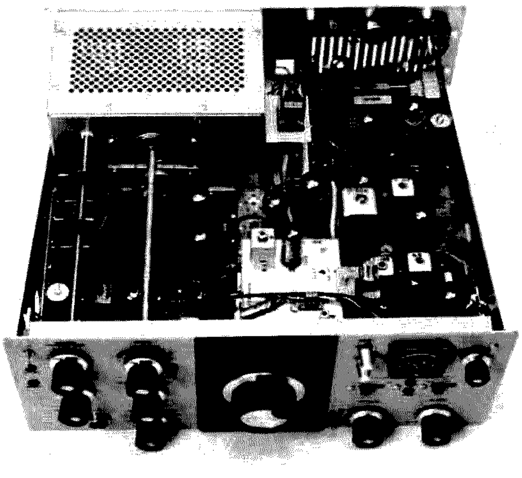


Photo C. Note "missing" calibrator components and rear-panel sidetone control. The relay on the rf cage is for outboard vfo control.

Like some of the other modifications, this one requires a new hole in the front panel. What worthwhile project doesn't? I bought my rig to use, not to sit under a dust cover waiting for resale. Besides, the trade-in allowance on a kit-built, non-WARC transceiver is debatable to begin with, so I've had few concerns about reaching for my drill.

First, remove the combination rf-gain control and switch lever. Disconnect all wires from the slide switches and crystal filters, and take off the back of the DPDT slide switch. Take a deep breath if you must, and drill a hole centered between the letters T and E of the word FILTER, of sufficient diameter to pass the new toggle switch.

Install the miniature relay into the now-empty frame of the slide switch nearest the center shield, using double-sided tape to secure it. Make the connections to the new toggle switch before installing it on the front panel because it's impossible to reach once it's in place. Reconnect the crystal filters as shown, and position the new switch to coincide with the arrow and SSB/CW markings on the front panel.

Finally, install a new 100k linear-taper potentiometer for the rf-gain control. If the new hole was correctly centered, the toggle-switch nut and washer should cover the word FILTER, leaving a new control that looks (almost) factory standard.

By maintaining the original distance between input and output poles of the filters, I haven't been able to detect any degradation in

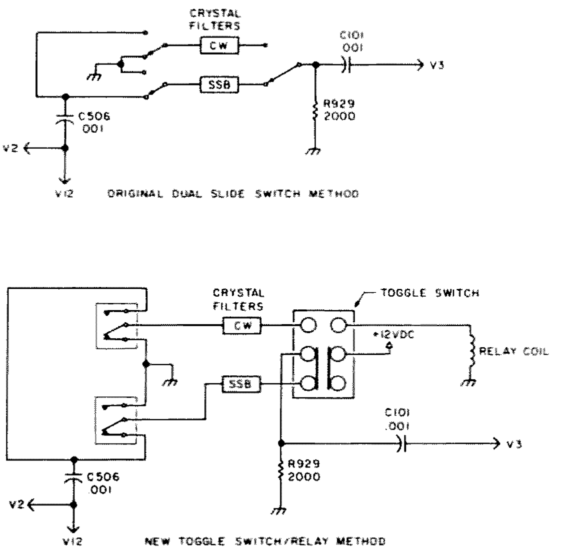


Fig. 5. The unreliable and noisy slide switches are replaced with a toggle switch and relay for crystal-filter selection.

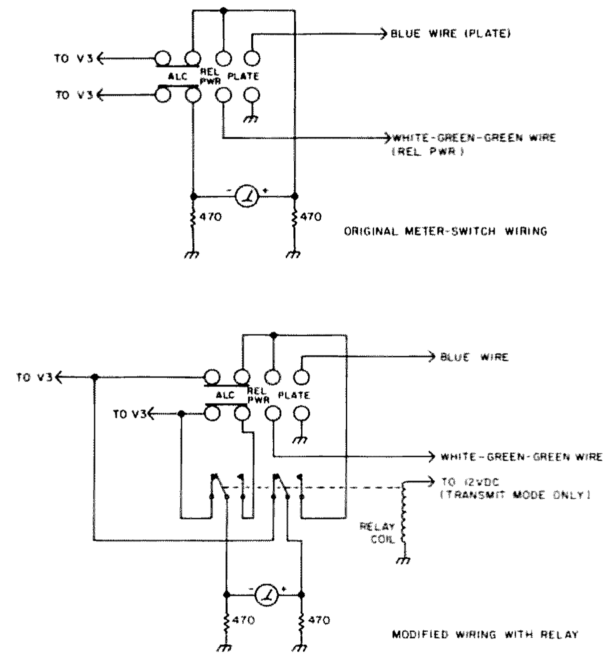


Fig. 6. The new relay makes the S-meter independent of the meter switch. Observe meter polarity when connecting relay to switch.

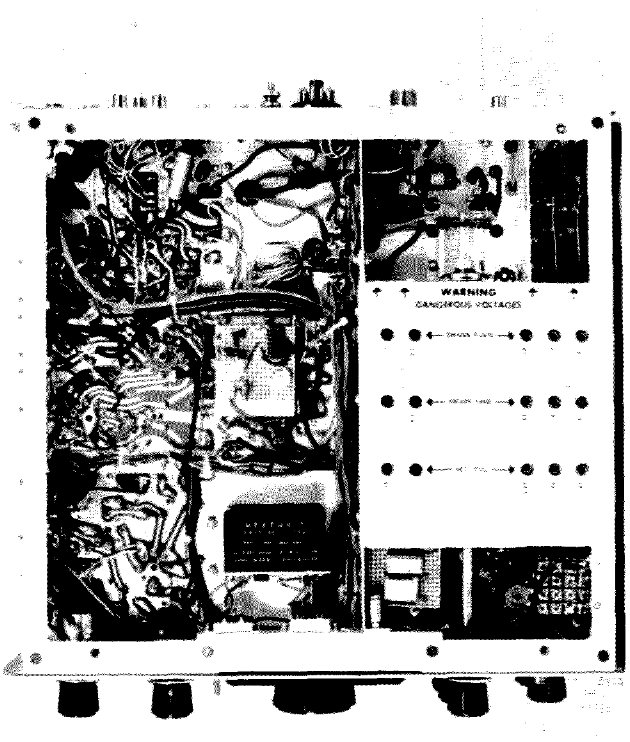


Photo D. Bottom view, showing placement of dc power supply, calibrator, crystal-filter relay, WWV board, and microphone preamp.

performance or additional leakage around the filters. But you will detect both if you use a three-section switch in place of the relay, or otherwise decrease the input/output isolation.

This switching method can be used for adding a CW filter to other transceivers that have no provision for one, such as the HW-100 and SB-100.

Full-Time S-Meter

As originally designed, the S-meter in the HW-101 works only with the function switch in the ALC position. Without a lot of wear and tear on the meter switch, it's not possible to monitor plate current while transmitting and signal strength while listening. If you want to keep your S-meter on the job all the time, take a look at Fig. 6 and make these changes.

Mount a relay and two 470-Ohm resistors on a small piece of perfboard, and wire as shown. The assembly can be attached at any convenient location near the meter. Don't forget to clip the original resistors from the meter switch.

In receive mode, the meter bypasses the switch and is always connected to tube V3, the source of S-meter voltage. When transmitting, the relay is closed and connects the meter to the switch, where any of the three meter functions are selected normally.

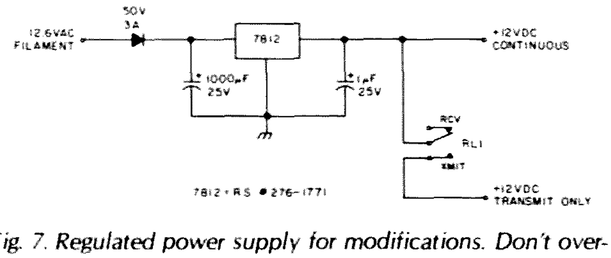


Fig. 7. Regulated power supply for modifications. Don't overlook the 1-μF capacitor at the 7812 output.

VOX Controls

Hiding the VOX controls on the side of the rig makes for a clean, uncluttered front panel. But it's hardly a convenient location for controls that are adjusted every time you change from CW to phone. I thought it was only sensible to relocate the delay and gain controls to the front panel; the set-and-forget anti-trip isn't worth moving.

The existing controls do not have shafts and can't be used with knobs. There's room for new controls to the left of the meter, but be careful not to crowd the tuning dial. A 10-megohm linear-taper pot is a good substitute for the hard-to-find 7.5-megohm delay control.

Route the lead from the delay control through the notch in the i-f board and back to its original location underneath V12. The shielded cable from the gain control can be strung across the vfo and soldered directly to the mike gain control, where coax cable #3 is now connected.

Power Supply

For some of the modifications in this article, 12 volts dc is needed. This is not available in the HW-101, but it's easy to build in a small power supply. Filament voltage is borrowed from point 12 on the foil side of the bandpass board, where the large brown and white wires are connected. The circuit is shown in Fig. 7. The rectifier and filter components can be mounted on a small terminal strip.

Attach the 7812 regulator and the terminal strip to the center shield near the antenna relay. Twelve volts dc is available continuously on demand to most circuits, but on transmit only (via spare contacts on the antenna relay) for the S-meter relay and any future additions.

And Finally...

With nothing but phono sockets on the rear panel, it's all too easy to load up the station speaker on 40 meters. Of course you can do this only once per speaker, so it might be better to replace the antenna socket with an SO-239 coax connector. A reamer or 5/8-inch punch will enlarge the existing hole.

A vfo spinner knob with a finger hole is the poor ham's economy scanner. You still have to turn the knob, but it goes much faster. The one used on the SB-104 (Heath part no. 462-906) works well and matches the HW-101.

Some early versions of the HW/SB series used 1N34 diodes in the balanced modulator. Later, they were changed to FH-1100 hot-carrier diodes for better audio quality. Check your owner's manual to see which type you have. If you want to make a change, the four diodes are located on the modulator board, right behind the mode switch. FH-1100s are Heath part no. 56-87.

This article is only a fraction of all that's been written about the HW-101 and the almost-identical HW-100 and SB-100 series. The basic design of these popular rigs is not yet outdated, and the specifications compare favorably with many "hybrid" transceivers at double the price. These radios offer good performance to start with, and can be further improved by any owner with even limited workbench experience.

So don't be afraid to raise the hood and poke around. There's not a single component inside your HW-101 that can be damaged by the static electricity on your fingertips. If you have any questions or problems, let me know, and I'll try to help. ■

Robert K. Morrow, Jr. WB6GTM
3650 Rocky Knoll Drive
Colorado Springs CO 80918

Hunt the Auto-Fox

Has your transmitter-hunting gone sour? DFers will love chasing this wily box, and its variable skill levels give them a run for their money.

Many radio clubs across the country participate regularly in hidden-transmitter hunts. The Pikes Peak Radio Amateur Association, for example, has a fox hunt once a month, with each month's winner play-

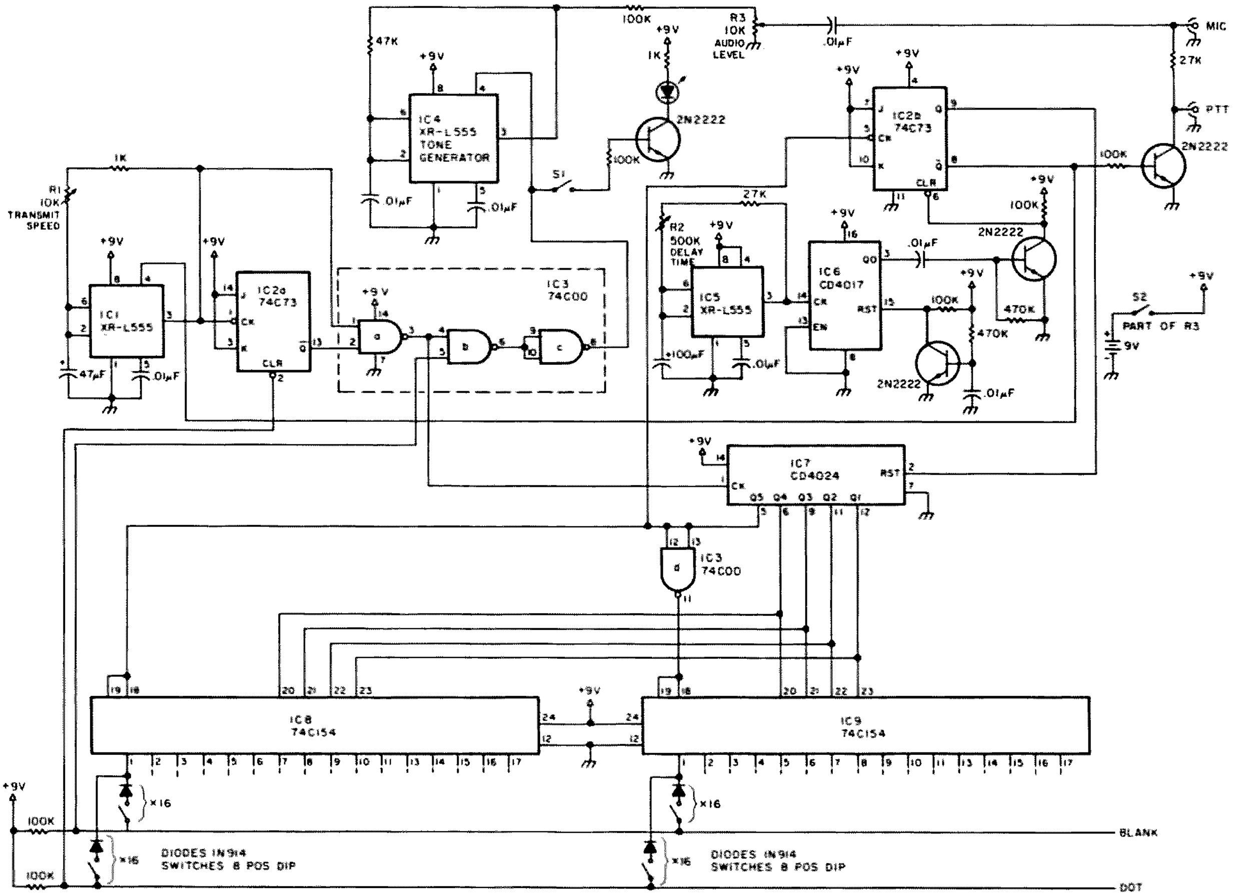


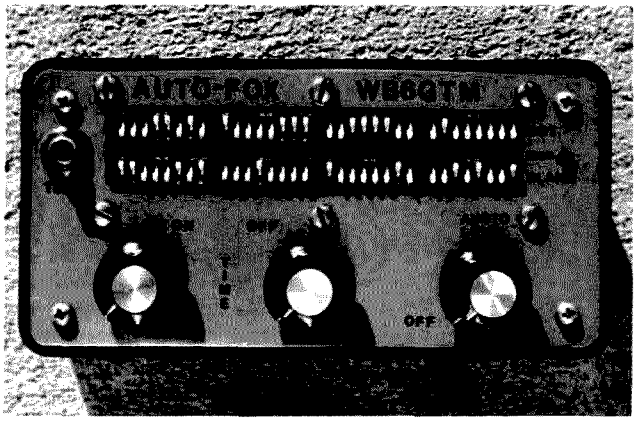
Fig. 1. Schematic.

ing the role of the fox the following month. When he/she is in place, the rest of the participants begin the hunt from a predetermined meeting area. The new winner is the person who finds the fox after traveling the shortest distance.

This game is lots of fun, of course—at least for the participants. However, the fox usually becomes quite bored with the whole process while sitting in a car somewhere and transmitting for one minute out of every five.

This problem can be alleviated somewhat by the use of the Auto-Fox, a device which attaches to just about any transceiver and sends a preprogrammed callsign in code at intervals determined by the operator. Now the real fox can read a book at least, or listen to the radio, or even rag-chew on a different frequency without being interrupted every few minutes for a fox-hunt transmission.

Built with CMOS devices, the Auto-Fox draws about one milliamp of current and should run for many hours using a 9-volt transistor-radio battery as a power source. Any callsign can be programmed with the DIP switches on the front panel of the device, and the operator has full control over the length of transmission (10 seconds to 1 minute), the time between transmissions (1 to 12 minutes), and the audio level into the transmitter.



The Auto-Fox was built using point-to-point wiring on parts of a protoboard and put into a Radio Shack 270-233 experimenter's box. The top panel contains the callsign programming DIP switches, transmit speed, delay, and audio level/on-off pots, as well as the push-button switch which activates the monitor LED. The right side of the enclosure (not shown) has a subminiature mike jack, a miniature PTT jack, and an external power connector.

Circuit Description

The Auto-Fox is based upon a clever repeater IDer designed by K2OAW.* The circuit is designed entirely with CMOS and low-power 555 timers (Fig. 1) for operating currents of just over 1 mA when transmitting and just under 1 mA between transmissions. Logic designers call this a "counter-based controller" since operation is controlled by binary counter IC7 and its clock, IC1. The DIP switches on the front panel of the Auto-Fox allow the system to produce a dash when both switches are open for a particular count, a blank by turning off the audio genertor, IC4, or a dot by increasing the count speed by bypassing IC2a. IC8 and IC9 allow for 32 counts, each of which can be programmed independently as a dot, dash, or blank. The Auto-Fox can produce the longest US callsign, which consists of 29 counts including the 5 blanks between characters. The 10k pot on IC1 allows a callsign to be transmitted in a minimum of about 10 seconds or up to a maximum of about 1 minute.

The interval between successive callsign transmissions is determined by IC5 and IC6. The decade counter at IC6 is used in a divide-by-ten configuration to allow smaller timing components on IC5; the decade counter also has a power-on start feature on pin 15, so the fox will begin a transmission cycle when first turned on. This feature also allows the user to transmit an ID at any time simply by turning the Auto-Fox off for a moment, then on again. The 500k pot on IC5 sets the time between transmissions from a minimum of about 1 *minute* to a maximum of about 12 minutes.

When the push-button switch on pin 8 of IC3c is pressed, the LED will turn on whenever IC4 is producing an audio tone during the transmission cycle. Of course, a momentary switch is used here to prevent inadvertent draining of the battery by extended LED operation.

The mike output of the Auto-Fox will provide a variable-level audio tone to the microphone input of the companion transceiver and is configured to provide the correct push-to-talk (PTT) logic to the ICOM IC series of handie-talkies as well. A separate PTT output also is provided by the Auto-Fox for other transceivers requiring this additional control signal.

Construction and Operation

Parts layout of the Auto-Fox is not critical, and just about any convenient arrangement can be used. I tried to miniaturize my design as much as possible and managed to put everything into a Radio Shack experi-

Parts List

Quantity	Type	Description
3	IC	XR-L555 (276-1718)
1	IC	74C00 (276-2411)*
1	IC	74C73
2	IC	74C154
1	IC	CD4017 (276-2417)
1	IC	CD4024
4	Transistor	2N2222 (276-2009)
64	Diode	1N914 (276-1122)
6	Capacitor	.01 μF (272-131)
1	Capacitor	47 μF (272-1027)
1	Capacitor	100 μF (272-1028)
2	Resistor	1k Ω (271-1321)
2	Resistor	27k Ω (271-1340)
1	Resistor	47k Ω (271-1342)
5	Resistor	100k Ω (271-1347)
2	Resistor	470k Ω (271-1354)
1	Pot	10k audio w/SPST SW (271-215)
1	Pot	10k linear (271-1715)
1	Pot	500k linear (271-210)
8	Switch	8-pos. SPST DIP (275-1301)
1	Switch	SPST push-button NO (275-1547)
1	LED	General purpose (276-026)

Radio Shack part numbers are in parentheses; other parts available from Jameco Electronics, 1355 Shoreway Road, Belmont CA 94002.

*Functionally equivalent to 74C00, but pin assignment differs.

*"A TTL Logic CW ID Generator," Peter A. Stark K2OAW, 73 Magazine, February and March, 1973.

menter's box (270-233). However, unless you are an experienced builder, I recommend that you gain some working room at the expense of using a slightly larger enclosure.

If the Auto-Fox is to be used with only a single callsign, you may want to save the cost of the DIP switches and extra diodes by hardwiring the callsign to the 74C154 chips, using only the required diodes.

Unlike most sequential digital circuits, the Auto-Fox operates slowly enough so that you can see most of the logic transitions on a voltmeter, which makes troubleshooting substantially easier. You can also temporarily short across the push-button switch to activate the LED continually for a simple operational check.

Once the Auto-Fox is operating correctly, construct the proper patch cords between the unit and the mike and PTT (if applicable) connections of the companion transceiver. Use a receiver to verify correct operation of the complete system, and adjust the transmit time, delay between transmissions, and audio level as required. The Auto-Fox is now ready for the hunt!

Conclusion

Since any callsign may be programmed into the Auto-Fox, it may be tailored to the person who happens to be the fox on a particular hunt. As the hunters become more proficient, the transmit time may be decreased by increasing the speed of the ID, thus requiring a faster direction fix. Also, the time between transmissions may be increased to provide fewer opportunities for a fix.

The Auto-Fox should take some of the boredom out of being the fox and will provide a precise signal which can be programmed for just about any direction-finding situation. ■

Surviving the Unthinkable: Part III

WA8YKN outlines simple precautions that will allow your radio equipment to survive an electromagnetic pulse.

Editor's Note: Parts I and II of "Surviving the Unthinkable" appeared in the May and June, 1982, issues of 73.

Thomas M. Miller WA8YKN
936 Belmont Avenue
Mansfield OH 44906

One of the primary justifications for the very existence of amateur radio is emergency communications. Indeed, amateurs all over the world have volunteered their skills in times of need, and we can look with pride on our record to date.

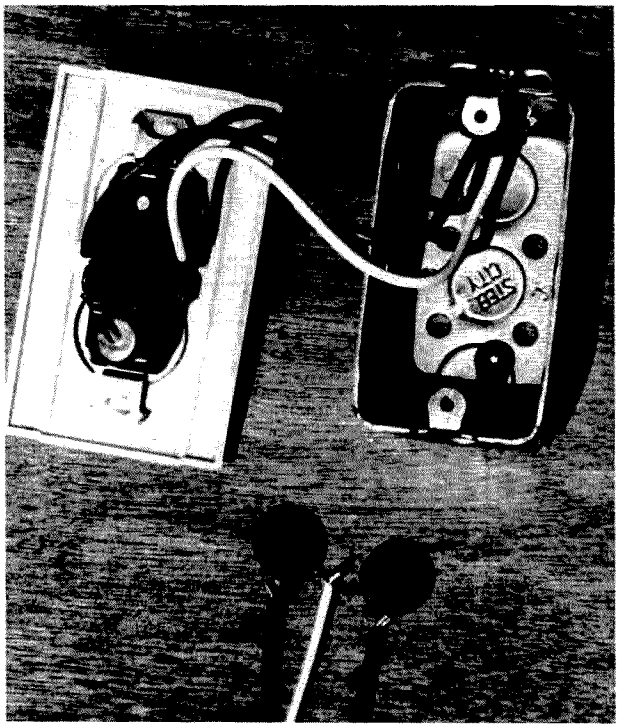


Photo A. Electric outlet with MOV spike suppressor properly installed. Below, two MOVs are connected in series for installation on a 220-volt line.

However, with today's ever-present nuclear threat, there exists a potential for the greatest communications disaster ever imagined, and there is a very great possibility that this time amateur radio might not be able to do the job. The danger to commercial, military, and amateur communications is EMP, electromagnetic pulse.

When a nuclear bomb is detonated, electromagnetic energy is released across the entire spectrum, from extremely low frequency up through radio frequency, infrared (heat), and right on through visible light to gamma rays. This massive release of broad-spectrum energy can cause large-scale disruption of radio propagation.

However, the situation could be much worse. If the device were detonated above the atmosphere, say 300 miles or more, the high-energy gamma rays released in the first split second of the explosion would crash into the molecules of the upper atmosphere, knocking electrons loose. These electrons would be gathered up by the earth's magnetic field, where they would be deflected to the planet's surface. The result is a discharge of extremely high voltage which finds its way to ground through any conductor available, much like a bolt of lightning does.

Just as lightning striking an antenna will destroy a radio on its way to ground, the high currents generated in cables, overhead wires, antennas, and other conductors can destroy electrical equipment connected to them. This can cause loss of electrical power, telephone service, and other serious problems. But the EMP isn't through yet. The large current flowing through all these conductors to ground generates a huge electromagnetic field, and that's the real problem for solid-state electronics, amateur radio included.

When an electromagnetic field collapses, it will generate *induced* current in any conductor which happens to "cut" its lines of magnetic force. The magnitude of the induced current is proportional to the intensity of the field that created it.

The field intensity of an EMP caused by a nuclear device of moderate size exploded above the atmo-

sphere can reach 50,000 volts/meter in the first ten billionths of a second.

The problem to radio amateurs is clear. The initial voltage pulse from either the ac power line or from the antenna and feedline can destroy an amateur-radio station. And even if the antenna and power are disconnected, the currents induced by the collapsing magnetic field into the very circuits of the radio gear can destroy transistors and integrated circuits with ease.

The similarity between the effects of EMP and lightning are striking (pun intended). However, while a lightning strike might damage some equipment in the general area, the EMP from a nuclear blast would cover a much larger area. In fact, if the device were detonated around 400 miles above the central US, the resultant EMP could damage equipment over most of the country! Imagine lightning striking every power line, radio tower, and telephone pole in the country *simultaneously* and you can begin to realize the extent of the EMP threat.

In 1962, during a series of high-altitude weapon tests, a 1.5-megaton bomb called "Starfish" was detonated 250 miles above Johnston Island in the Pacific Ocean. Instantly, lights winked out and burglar alarms rang all over Hawaii, over 600 miles away! Such an effect from so small a device was unexpected and began the first real look into the EMP problem.

No one is more concerned about EMP than the military. Since the Nuclear Test Ban Treaty prohibits atmospheric tests, a way had to be found to simulate the effects so that various protective measures could be evaluated. One such EMP simulator is "Trestle," located at Kirtland AFB in New Mexico. Trestle has a platform twelve stories high which can support a B-52 bomber. In order to simulate a free-space condition, the entire structure is made of wood! 250,000 wooden nuts and bolts hold the structure together. Trestle can generate five million volts which is discharged through antennas surrounding the structure.

The results of tests at Trestle and other simulators seem to indicate that the actual effect of EMP is pretty hard to predict. In fact, in a study by the National Research Council Committee, it was found that the effects of EMP often varied from predicted results by as much as 100:1 in either direction!

Even though test results have often been unpredictable, enough data has been gathered to suggest that there is much that we, as amateurs, can do to protect our equipment from the effects of EMP. It is important that we take these steps if amateur radio is going to be of any value in the event of an EMP emergency. Let's take a look at the typical amateur station and see what can be done.

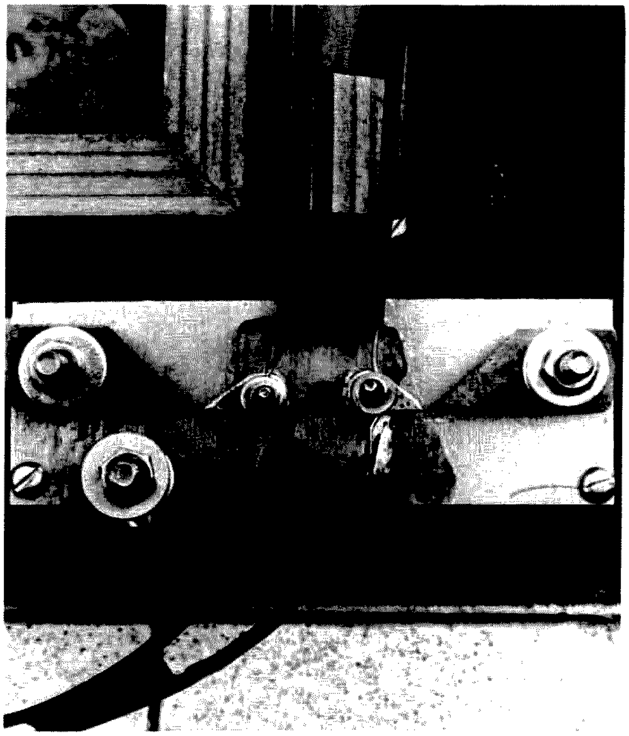


Photo B. A simple home-brew high-voltage discharge gap for open-wire feedlines.

Power lines: The best bet for ac power is to supply everything from a single fused disconnect located at a convenient spot in the room, to be used as a "master switch." This way the station, when not in use, would not be vulnerable to large spikes propagating down the ac line.

To offer some protection while in use, a transient suppressor such as a GE-MOV (General Electric metal-oxide varistor) should be installed from each ac line to ground at the disconnect. An additional MOV should be installed across each outlet into which the equipment is plugged. (See Photo A.)

Another source of trouble here is the three-wire cord. These things are fine to prevent your toaster from electrocuting you if it should develop a short, but on radio equipment they are an invitation to ground loops, and in the event of an EMP or lightning strike, currents can be induced from the ac line to the third "ground" wire, causing large circulating currents in the chassis itself. That brings us to the next point.

Grounding: If we are going to spare our equipment from EMP, we have to offer it something more attractive. We need the *best* ground we can possibly get. The standard eight-foot copper ground rod is a good starting point. Even better is several ground rods several feet apart joined together by a heavy (#8 or larger) wire just below the surface. The ground should be located near the equipment so that the connecting wire is as short and straight as possible.

Many amateur stations are located near a window to provide easy ingress of feedlines, and this is an ideal place for the "station ground." Mount a plate of 1/4-inch aluminum to the windowsill and connect it directly to ground. Now *all* equipment in the shack is connected *individually* and *directly* to the ground plate using #8 aluminum wire. The cold water pipes, the tower base, the neighbor's chain-link fence, in short all the various large metal objects that hams are known to hook into the ground system, should all be connected to the common ground plate. Everything connects to *one point!* This is why we cut off all the grounded plugs in the previous step. Does your house have aluminum siding? Ground it! Not only will it provide lightning protection, but it will also provide a degree of shielding.

Feedlines should each be provided with a good lightning arrestor at the point where it enters the house. Coaxial feedlines can use the arc-gap type, such as the Cushcraft "Blitz-Bug" or something similar. For open-wire line or twinlead, a simple arc gap can be made

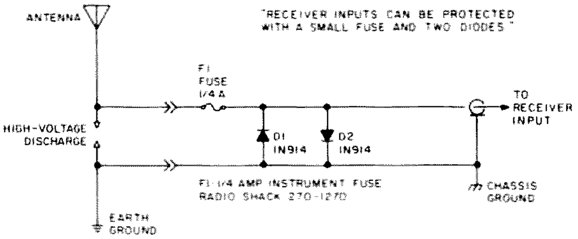


Fig. 1.

from copper or aluminum. (An example is shown in the *Radio Amateur's Handbook*. See Photo B.) Whatever type of suppressor is used, connect it directly to the station ground.

Even with the lightning arrestors, it's a good idea to ground all feedlines when not in use. The rotary switch commonly used to select coax-fed antennas usually will ground all inputs but the one in use. Open-wire feedlines can be grounded with a large knife switch.

Feedlines can also be fused with fast fuses such as the Buss ABC type. The input to a sensitive receiver can be protected with a 1/4-Amp fuse such as the kind used to protect the input of a delicate volt ohmmeter. Back-to-back diodes should be added across the antenna terminals to shunt the pulse to ground, blowing the fuse before the receiver is damaged. (See Fig. 1.)

If the equipment in your shack is tube-type, the above steps may be all that is needed to offer reasonable protection from EMP. Once we've provided a good ground and shunted off the primary surge, tubes are usually quite capable of withstanding the voltages induced in the circuits by the collapsing field of the EMP. However, if your equipment is solid state, you may have to look at the final category in our EMP protection plan.

Shielding: The field generated by the EMP will not cause current to flow in the circuits of our equipment if we prevent the magnetic lines of force from reaching those circuits. Many commercially produced transceivers on the market today are very well shielded. Some are not. This will have to be determined on a case-by-case basis. Things to watch are seams and cracks in cabinets, and jacks for connecting cables. The "Construction Practices" chapter of the *Radio Amateur's Handbook* gives practical information on making radio equipment truly rf-tight.

As we look back over all the above steps to protect our equipment from EMP, one fact stands out clearly: *All of the steps are extensions of normal amateur practice!* There is nothing secret or exotic here, not even anything difficult or expensive. In fact, if you read the building codes governing radio stations, you will probably find that most of these switching and grounding techniques are *required by law!* But even though we all know about proper grounding, lightning suppression, etc., how many amateurs have taken the time to do the job right?

By taking the steps outlined above, we can stand a much better chance of providing the service our neighbors expect of us should the electromagnetic pulse ever threaten our normal communication channels. At the same time we will be making our amateur-radio stations better organized, less likely to cause TVI, and above all, safer! ■

David S. Komm KD6VP
1814 Schilling Court
Torrance CA 90501

Scope That Signal

Are you overmodulating? Is your linear linear? Find out with a station monitor you've built from scratch.

Do you worry? I do. When I operated SSB, I always used to worry about whether my rig was adjusted properly to put out the best possible signal. My rig, like many transceivers today, uses a linear stage for the final amplifier regardless of the mode of operation, be it SSB or CW, and the only instrumentation provided is the ubiquitous panel meter. In addition, I had a directional coupler for measuring forward power and vswr. With this arrangement, tuning up for CW is no particular problem: Just put the key down, keep the plate current more or less dipped (it's a vacuum-tube final), watch the forward-power meter, and tune for maximum smoke (that is, forward power) while not exceeding a certain maximum allowable value of plate current.

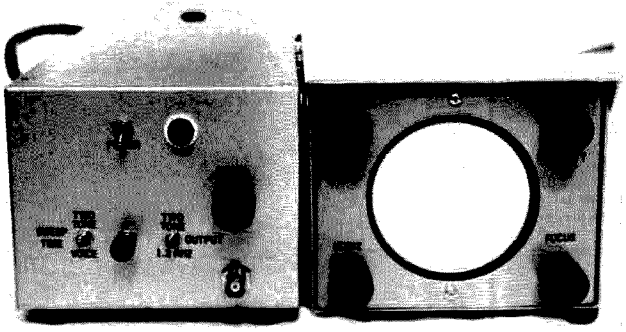


Photo A. The monitor scope is built in two enclosures. The one on the left contains the power supplies and the main circuitry.

With SSB (and to a lesser extent AM, assuming there is anybody out there still running AM) the problem is not so easy, however. Since panel meters can't respond to the instantaneous changes in the transmitter during modulation, an oscilloscope must be used for monitoring the true state of the transmitted signal. Some fine monitor scopes designed specifically for amateur use are available commercially, but the prices are rather steep. Consequently, most of us fall back on the time-honored procedure of setting the rig to the Tune position, putting out a single CW note, and tuning for maximum forward power. When the rig is switched back for SSB modulation, we just hope everything will come out OK. Nevertheless, this still leaves unanswered the question of whether the rig is properly tuned up. Being the sort who worries endlessly about such little questions, I used to sit there and worry.

This state of affairs persisted up until August, 1983, when the FCC finally changed the rules on maximum allowable power for the Amateur Radio Service. Whereas previously we were limited to 1-kW-dc *input* power with no limit on output power, now we have a 1500-Watt limit on PEP *output* power with no limit on dc input power (except for AM DSB which temporarily remains unchanged). In order to most effectively utilize the new rule, we now need the ability to make accurate output-power measurements for all modes of operation. An oscilloscope nicely meets this requirement. Consequently, I finally came to the decision that I had to have a monitor scope. With the prices of the commercial units making them out of the question for me, I would have to build one.

What follows is a description of a monitor scope that is relatively easy to build and that is cheap. The whole cost was less than $50.00, exclusive of the price of the

CRT (which was already on hand, having been obtained many years previously by a method so unlikely as to be quite unbelievable). The device includes a built-in two-tone signal generator and a two-speed linear-sweep generator, one sweep speed being used for examining the two-tone test pattern (or just a single-tone pattern for AM rigs) and the other speed being used for examining voice patterns during normal station operation.

While most readers will not wish to duplicate the unit in its entirety (especially the toroidal transformer for the horizontal-sweep voltage), the main circuitry is so straightforward that it should serve as an excellent starting point for those wishing to build their own monitor scope. Those who already have a general-purpose oscilloscope equipped with an external input to the horizontal amplifier (which also provides, or can be adapted to provide, a direct connection to the CRT vertical-deflection plates) will need to build only the main circuitry and the low-voltage power supplies to obtain a first-class scope.

General Description

Fig. 1 is a block diagram of the monitor which illustrates the key features of the unit. A 12-kHz pulse generator is the initial source for each of the two sine waves used for the two-tone signal (1200 Hz and 2000 Hz) and it also is the source for the trigger pulses for the CRT sweep waveform. The 1200-Hz sine wave is derived by digitally dividing the 12-kHz pulses symmetrically by ten, and then passing the resulting square wave through a 700-Hz low-pass active filter. The 2000-Hz sine wave is similarly derived, except that the division is by six and the low-pass filter has a cutoff frequency of 1100 Hz.

The two sine waves are then linearly added in a strobed adder circuit driven by a separate asynchronous pulse generator running at about 10 Hz. By adjusting the duty cycle of the asynchronous pulse generator to approximately 33%, the resulting pulsed two-tone test signal can be continuously applied to the transmitter under test without exceeding the transmitter's maximum dissipation limits. At the same time, the CRT display appears to be continuous and can be examined at your leisure. While the trick of pulsing the two-tone test signal is not new,[1,2] its use has not appeared in the literature for a long while; it is a technique worth remembering. Provision is also made for running the adder continuously; in this manner the PEP dc input power may more easily be determined (see below).

Besides generating a two-tone test signal, the monitor also can provide just the 1200-Hz sine wave as a test signal for use with AM rigs. Since AM transmitters must have sufficient dissipation capability to run with continuous modulation, the 1200-Hz signal need not be pulsed.

In addition to the sine waves, the trigger pulses for the sweep generators are also derived by digital division. The 2000-Hz square waves are further divided by ten to provide 200-Hz pulses for triggering the 4-ms sweep generator, and by 60 to provide 33-1/3-Hz pulses for triggering the 24-ms sweep generator. The 4-ms sweep displays 3.2 complete beats of the 800-Hz difference between the two sine waves, while the 24-ms sweep is a convenient speed for viewing voice patterns.

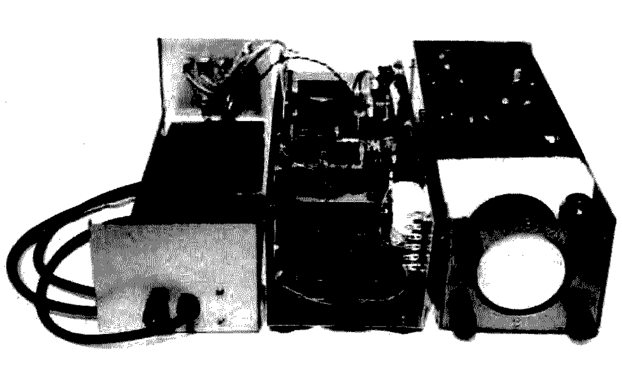


Photo B. Interior view of the monitor scope. The power supplies are at the rear.

It is important to note that by this choice of division factors (2, 5, and 6), the 4-ms-sweep repetition rate of 20C Hz is an exact submultiple of both of the sine waves; and since all three waveforms are derived by digital division of one common oscillator, the relative phases of the three waveforms are fixed and cannot change even if the 12-kHz oscillator drifts in frequency. In this manner an unconditionally-stable CRT display is produced without the complication of involved level-sensitive trigger circuits such as are found in the normal measurement oscilloscope. The 24-ms-sweep divisor chain, while mainly intended for voice-pattern observation, also contains the same division factors; it, too, will produce a stable two-tone pattern if desired. Similarly-stable AM-envelope test patterns are also produced.

Main Circuit

The main circuitry which forms the heart of the monitor scope is shown in Fig. 2. A 555 timer, U1, is the 12-kHz pulse generator, with R1 providing fine frequency adjustment. The exact values shown need not be used, but all resistances and the

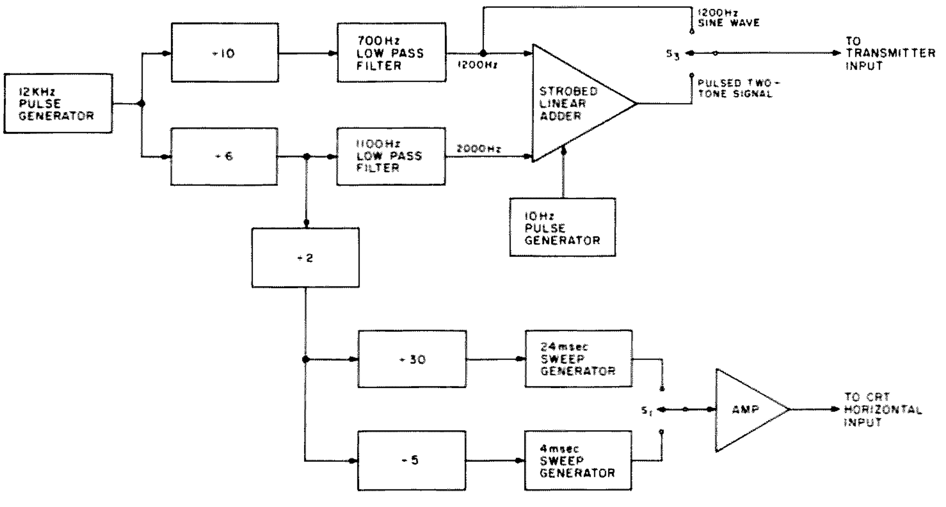


Fig. 1. Block diagram.

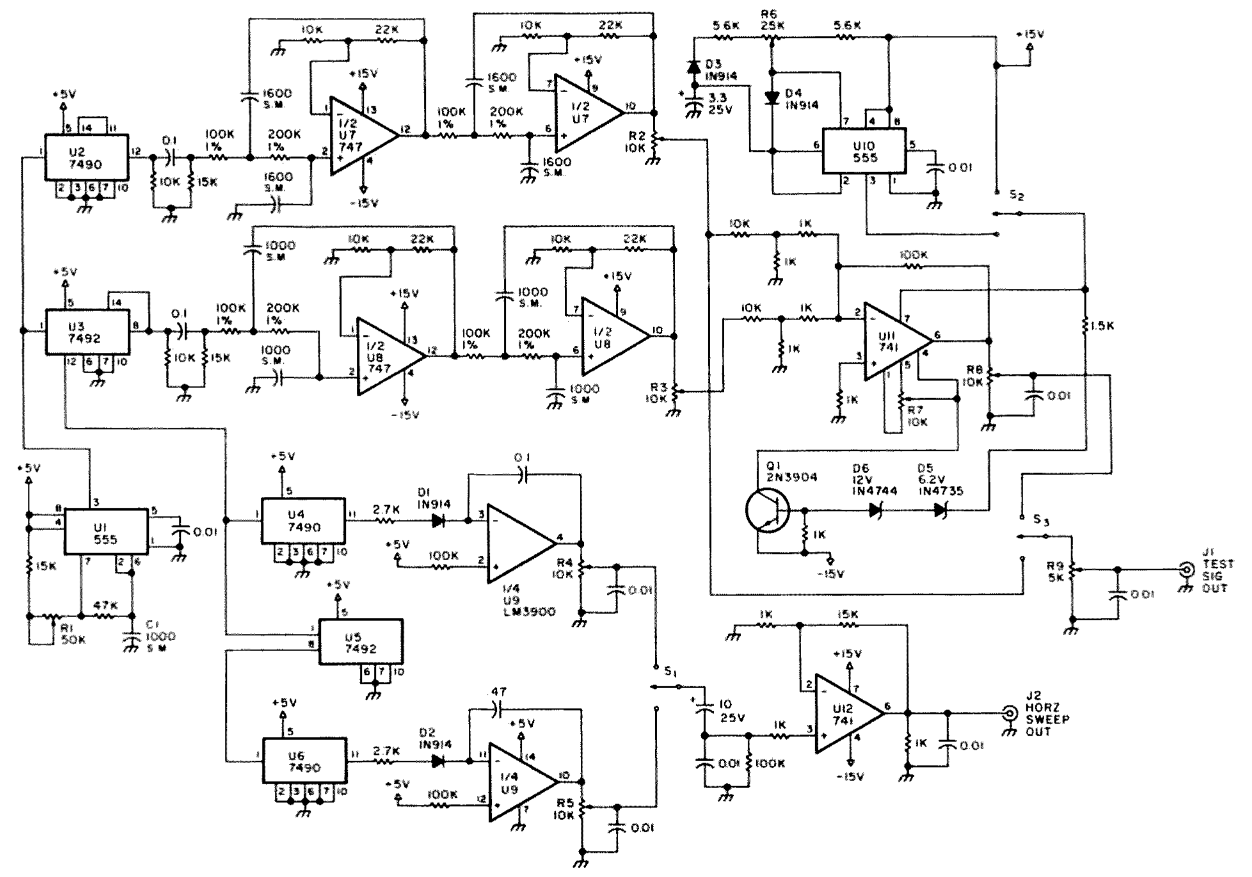


Fig. 2. Main circuitry.

value of the timing capacitor, C1, must be changed proportionally if the 12-kHz oscillation frequency is to be maintained. Although drift in the oscillator frequency will not cause the CRT display to change, a capacitor with good stability, such as a silvered mica or a polycarbonate, should be used at C1.

U1 directly drives the divider chain of U2 through U6. Initially, regular TTL packages were used, but the current consumption was over 150 mA, which proved to be a little too much for the heat sink used on the +5-V-dc regulator. Low-power Schottky devices were substituted and the current consumption dropped to around 65 mA.

The 1200-Hz square waves from U2 are applied to the input of the 700-Hz, two-stage, active low-pass filter formed by U7, while the 2000-Hz square waves from U3 are fed to the 1100-Hz filter formed by U8. In this case, type-747 packages (dual 741s) were used, but individual 741s may be used if desired (or a single LM348—quad 741s—can be used if obtainable). Both of the filters are implemented using the op amps as non-inverting voltage-controlled voltage sources with a passband gain of two (set by the 10k and 22k resistors). By picking the gain to be two and using equal values for the two frequency-determining capacitors in each stage, the formulae for the required resistances simplify to $R1 = Q/(2\pi fC)$ and $R2 = R1/Q^2$, where R1 is the input resistor (100k) and R2 is the resistor between the two capacitors (200k). The Q of the filters was set at 0.707 to prevent ringing.

Again, there is nothing sacred about the exact values used, and the ones shown here were picked entirely as a matter of convenience from parts on hand in the junk box. Thus the gain-setting resistors could just as easily have been 4.7k and 10k, or 22k and 47k, etc. If a capacitance value other than 1600 pF is desired, the 100k and 200k 1% resistors can be replaced according to the formulae above. However, resistance values much larger than the 200k shown here should be avoided to prevent difficulties caused by the op amp's input offset currents. Although 1% resistors are shown, 5% values can probably be used in the filters without any serious loss in performance.

The recovered sine waves from the low-pass filters are linearly added in U11. A package with a single op amp is required here to allow strobing. Stage gain is set for 100 to prevent an objectionable amount of signal feedthrough when power is not applied to the adder. The signal level out of the low-pass filters is about 1 volt peak. To prevent saturation of the adder, the level-setting pots, R2 and R3, attenuate the tones by a factor of ten; a further reduction is achieved by the 10-to-1 dividers between the pots and the input to the adder.

The 10k pot, R8, on the output of the adder allows the two-tone signal to be attenuated to the level of the 1200-Hz sine wave so that if you want to switch between the two-tone signal and the 1200-Hz sine wave when testing, the signal level to the transmitter remains the same. Either the two-tone signal or the straight 1200-Hz sine wave is selected by S3, and the level to the transmitter is set by R9.

A second 555 timer is

used for the asynchronous 10-Hz pulse generator that provides the strobed power for the adder; either these pulses or continuous power may be selected by S2. Use of the two blocking diodes, D3 and D4, divorces the charging-current path from the discharge-current path to allow duty cycles less than 50%. Equalizing zener diodes D5 and D6 provides the base drive for the V-strobe transistor, Q1, or a single zener in the 18-to-24-volt range could be used if available.

Two separate CRT sweep generators were built, each using 1/4th of an LM3900 package with the sweep speed being selected by S1 (the remaining two quarters were not used). Sweep time is determined by the capacitors, and it was felt that it was best not to put the selection switch in the capacitor circuit. Since the LM3900 operates from a single-ended supply, the sweep voltage is always positive and a blocking capacitor has to be used before the following amplifier to remove the dc component of the sweep waveform.

The leading edge of the trigger pulse from the divider chain sets the generator output low, and then the output starts rising linearly as soon as the trigger pulse goes low. The output continues to rise until maximum supply voltage is reached, at which point the generator locks up until the next trigger pulse resets it.

Consequently, to produce a linear sweep with no high-level dead time, the interval between trigger pulses must be less than the maximum available charging time for the capacitor. As long as this criterion is met, sweep time will be determined by the interval between trigger pulses and not by the value of the capacitor, *per se*. However, if the maximum available charging time is very much longer than the interval between trigger

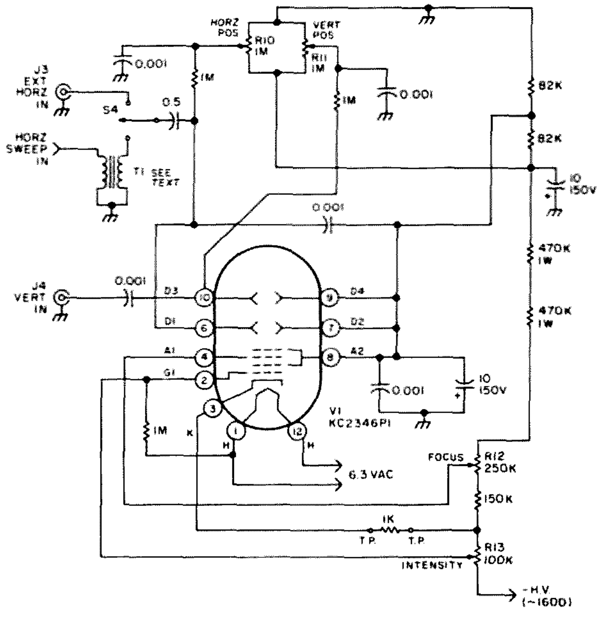


Fig. 3. CRT circuitry.

pulses, relatively little sweep voltage will be developed. Hence, for a given trigger-pulse interval, some reasonable capacitor value must be chosen. The values shown are about optimum for the trigger pulses used here, and the sweep-generator outputs are each about two volts peak. Equalization of CRT sweep widths are obtained with R4 and R5, and a sweep output of about 20 volts peak is produced by the U12 amplifier stage following the generators.

As mentioned previously, the circuit of Fig. 2 is all you'll need if you already have a general-purpose oscilloscope that has its own built-in horizontal amplifier and direct access to the vertical plates. If you fall into that category, you can skip the next section and go look at the power supplies. But if you want to start from scratch with just a CRT, the next section will show you how to do it.

CRT Circuit

In Fig. 3 you can see what's needed to hook up a CRT to get a usable trace. It's a simple circuit and is basically taken straight from any copy of *The Radio Amateur's Handbook* between 1962 and 1980. (I presume it's in later editions also.) All resistances are 10%, and all wattages are 1/2 Watt, except for the two 470k, 1-W resistors. There are a few changes from the basic *Handbook* circuit that are worth noting here:

Since the high-voltage supply I built provided 1600 volts, the voltage divider chain was adjusted to draw 1 mA at this voltage. I then picked the 100k and 250k pots and the 150k dropping resistor to roughly match the recommended range of operating voltages specified by the data sheet for the DuMont KC2346P1 CRT. This tube has a deflection sensitivity of about 25 to 30 volts per inch, so the 82 volts of plus-or-minus dc voltage on the plates guaranteed that the trace could be moved anywhere on the face of the screen. I'll give you 100-to-1 odds that you won't be using this particular CRT, but the adjustment range can easily be changed by altering the 82k resistors for any CRT you happen to have.

Don't forget to include the 1-M resistor that ties the heater to G1. Most CRTs aren't built to have more than about 150 volts between cathode and heater. You can run the resistor to the cathode instead of G1 if it's more convenient with your particular tube.

You will also note a .001-uF disc ceramic across the horizontal-deflection plates. This capacitor helps keep rf off these plates, and it will help extend the usable upper frequency limit of the CRT. Mount the capacitor on the CRT socket directly between the terminals for the horizontal plates to get the maximum possible benefit.

The 1k resistor, in series with the cathode, is used to measure beam current to verify that you are not drawing excessive current from the electron gun. The current is determined by *carefully* measuring the voltage drop across the resistor. Be *extremely* careful if you do this, because the whole meter and its leads will float up to almost the full value of the high-voltage supply. A shock from a 1600-volt supply is always a very serious matter, if not a fatal one.

Now comes the problem of how to get the necessary horizontal-deflection voltage to sweep the CRT. The DuMont tube was a three-inch tube, so it required something like 100 volts of sawtooth to sweep it. Some of the older and more common CRTs, like a 3AP1 or a 5BP1, have deflection sensitivities as low as 150 volts per inch, or worse. With one of these tubes, 500 or more volts of sawtooth might be needed. Sweep voltages of this magnitude are difficult to produce with common solid-state components—and besides, I didn't want to include yet another supply in the monitor. So instead I built the sweep transformer, T1, winding it on an Amidon FT-193-J toroidal ferrite core.[5]

Without going into the theory of transformer design, I want to point out two requirements that had to be met: First, there had to be

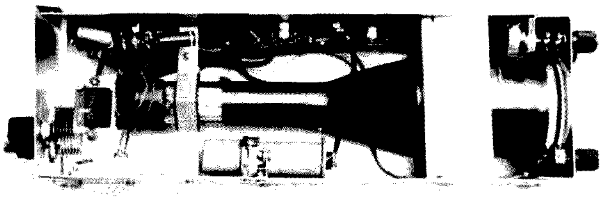


Photo C. Details of the CRT mounting. Note the clamps on the neck and the styrofoam block on the body of the CRT.

enough turns on the primary to avoid saturating the core, and second, the self-inductance of the primary had to be high enough to present a reasonably high impedence to the driving source. After a great deal of fiddling around, I determined that with this core, 200 turns on the primary would be enough for the fast sweep speed, so when I wound it, I used 300 turns to be safe.

For the secondary, I used 4500 turns to obtain a 15-to-1 step-up transformer. Since the U12 amplifier stage put out about 20 volts, I ended up with about 300 volts of peak sawtooth which was more than enough for the DuMont tube. However, at the slow sweep speed the core would saturate before a full-screen sweep could be obtained, so I had to limit myself to about 2.5" of deflection for voice patterns. Probably 400 turns on the primary and 6000 turns on the secondary would have been a better choice for this core.

Let me hasten to add that I had access to a toroidal-coil winding machine and I did not wind T1 by hand. Amidon now offers ferrite E cores which come in two halves, and with these cores a bobbin can be wound normally using an electric drill. This is a much more practical procedure for home construction. For anyone wishing to try an E core, I would recommend using one of the larger sizes rated for 100 to 200 Watts when used as a power transformer.

Another way to obtain the sweep voltage, of course, is to build a several-hundred-volt supply and use a vacuum-tube amplifier to develop the sweep voltage.

However the sweep voltage is obtained, provision should also be made for an external horizontal input to enable production of the trapezoidal pattern when checking AM rigs.

Power Supplies

The main circuitry requires power supplies to provide +5 volts, +15 volts, and −15 volts. If you plan to build a complete monitor scope from scratch, you will also need at least a high-voltage supply for the CRT. The supplies I used are shown in Fig. 4, which is pretty much self-explanatory. With the choice of windings as shown, transformer T3 is rated by the manufacturer to produce a nominal 34 V ac across the whole secondary. Any center-tapped transformer in the range of 30 to 40 volts and 25 mA or more should be satisfactory.

You can be quite flexible in the design of the high-voltage supply since most CRTs will work with anything from 1 kV to 2 kV or perhaps a little higher, depending on the tube. Check the manufacturer's data sheet or the tube tables to determine the maximum operating voltage, and then pick about 60% to 75% of that. Try to stay above 1 kV to get enough brightness. It's quite annoying if you have to turn off the room lights to see the trace clearly.

In this case, I was able to find at a local electronics surplus store a CRT transformer that matched my requirements very well: This transformer provided 1600 volts for the CRT, which was nearly optimum. Besides producing the correct voltage, be sure to use enough filter capacitance to keep the ripple low, otherwise hum will show on the trace. The exact value of capacitance needed will depend upon the current drain from the supply, the voltage sensitivity of the CRT deflection plates, and the electron gun focusing. In this scope, 1 mA flows in the equalizing resistors across the rectifiers, 1 mA flows in the voltage divider chain, and the CRT electron gun draws about 0.5 mA. Initially I used only 0.15 uF for the filter, and it wasn't enough. The measured ripple was 20 V rms.

The effect of the hum did not appear as a 60-Hz sine wave or as a general fuzziness of the trace as you might expect (I did!). Rather, with the sawtooth sweep applied to the horizontal plates, the effect was such as to produce a vertical pattern on the trace that approximately looked like the sawtooth waveform itself. However, since the sweep frequency was not related in any way to the line frequency, the trace was constantly rotating. This was very confusing. When I finally realized it was the effect of ripple, I added a 2-uF oil-filled capacitor from the junk box (that was marginally ok, but 10 uF to 20 uF would have been better).

One last warning: *Be Careful!* Supplies at this voltage require constant vigilance.

Construction

Construction of the moni-

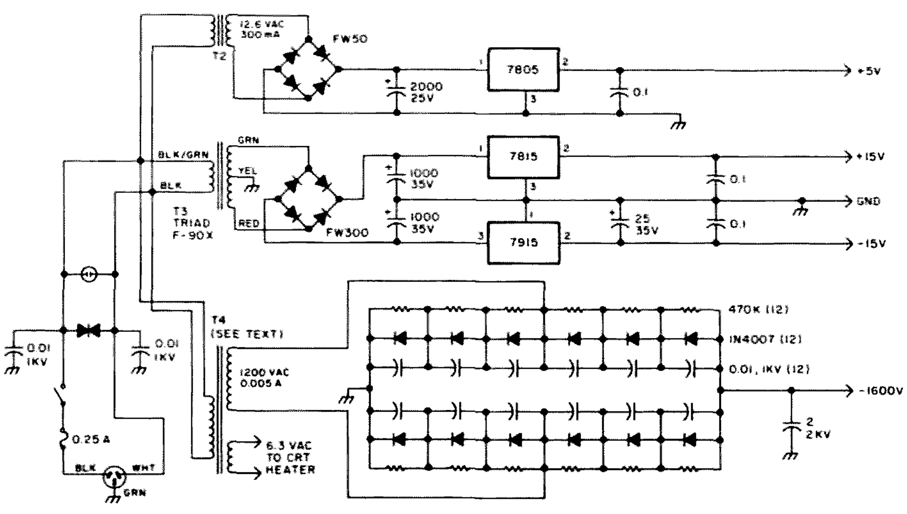


Fig. 4. Power supplies.

tor scope is straightforward. As shown in Photo A, the unit was assembled in two separate enclosures, one for the CRT and its associated circuitry of Fig. 3, and a second one for the remainder of the circuitry. The two enclosures were connected by a heavily-shielded cable. In this manner, the CRT was kept far away from the stray fields of the power transformers which otherwise could have blurred the oscilloscope trace. Point-to-point wiring was used in the CRT enclosure, while perfboard construction was used in the other. All ICs, U1 to U12, were mounted with sockets on the perfboard.

Mounting the CRT is a little tricky because of its fragility. The method used here is shown in Photos B and C. A screen was made of hard clear plastic by inscribing a centimeter graticule with a ruler and a sharp point. This screen was placed directly inside the enclosure over the opening for the CRT face. The face of the CRT was placed against the screen, and the CRT was supported on its large front diameter by cutting a tight-fitting hole for the CRT in a block of styrofoam® that was in turn fitted to the inside enclosure.

The neck of the CRT was captured and supported by two V-brackets made of aluminum strip. The brackets clamped the neck of the tube from above and below. Before clamping, a piece of rubber from an inner tube was placed around the CRT neck to prevent direct metal-to-glass contact. In this manner, the neck could be gripped quite securely without damage.

Special care in mounting was also needed for potentiometers R12 and R13, the focus and intensity adjustments, respectively: As can be seen in Fig. 3, these controls float at high voltage. They were mounted on a small piece of hard plastic, and insulating couplings were used to couple the shafts to the knobs on the outside.

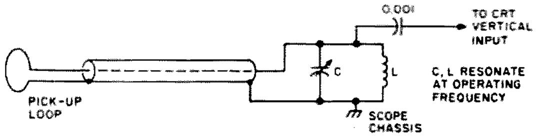


Fig. 5. Coupling rf to oscilloscope.

No other additional precautions have to be taken other than to use good engineering practice when wiring the CRT HV supply, and to use leads as short as possible for bringing the rf to the hot CRT vertical-deflection plate.

Adjustment and Checkout

If a general-purpose oscilloscope is available, it will be very useful for checking the operation of the main circuitry (although you can get by without one). If you can borrow one for the adjustment, it will be worth the effort.

Build the power supplies and get them working first; then start on the main circuitry. I found it useful to build one functional block at a time and check it out before I went on to the next. This method seems to make troubleshooting easier. If some method of checking frequency is available (e.g., a calibrated oscilloscope), adjust R1 to produce 12-kHz pulses from U1; otherwise set R1 to the middle of its range. Check for output from U2 through U6 to verify proper operation of the frequency divider chain.

Temporarily remove U7 and U8 from their sockets. Set S2 for application of continuous power to U11, and then adjust R7 for zero output on pin 6 of the 741. Reinstall U7 and U8 and then adjust the outputs from R2 and R3 for approximately 0.5 volts peak each. Adjust the output from R8 to equal that from R2. If an oscilloscope is available, adjust R6 to produce a 33% duty cycle in the U10 oscillator. If an oscilloscope is not available, this adjustment can be accomplished later when the two-tone generator is finished and an amplifier is under test by observing the plate current drawn by the final when driven by the pulsed two-tone signal: Adjust R6 until the current drawn is 1/3 of that drawn by the final when S2 is momentarily set for a continuous two-tone signal. Remember to use a dummy load since there is enough garbage on the air already!

Finally, after the main circuitry is driving a CRT, R4 and R5 can be adjusted to produce the desired sweep widths across the face of the CRT. R9 is most conveniently adjusted after the monitor scope is connected to the transmitter. It is set to produce a signal-level output equivalent to the output of the microphone used with the rig.

Coupling Transmitter to Oscilloscope

If a general-purpose oscilloscope is used, connection must be made directly to the CRT's vertical-deflection plates, unless the oscilloscope's vertical amplifier has a bandwidth great enough to pass the transmitter's output frequency, in which case the normal vertical input can be used. (But be careful not to blow out the vertical amplifier by applying too much power.) The horizontal sweep from the main circuitry's sweep generators can be fed to the oscilloscope's external horizontal input. Depending upon the power level of the transmitter and the deflection sensitivity of the CRT, various methods can be used to apply the rf signal to the vertical plates.

Methods that use a parallel resonant LC circuit connected to the CRT plates and a pickup loop coupled to the transmitter will work with very low power levels since the resonant LC circuit can develop a large rf voltage in spite of the power level. Fig. 5 illustrates this method. The pickup loop can be placed anywhere in the system beyond the point where any adjustments are to be made. Typical locations are a dummy load, an antenna tuner (transmatch), or often the transmission line itself.

If the power level of the transmitter and the deflection sensitivity of the CRT are well matched, sometimes merely a simple tee fitting can be inserted in the transmission line. The signal available at the arm of the tee can be applied directly to the vertical input to the oscilloscope through a blocking capacitor. At high power levels, the center conductor of the stem of the tee can be removed and replaced by a short stub which couples capacitively to the center conductor that remains in the cross arm of the tee. Modified tees of this sort can be constructed with different coupling coefficients for different power levels.

Transmitter Testing

With the oscilloscope coupled to the transmitter, the two-tone signal can now be injected into the transmitter through the mike jack. Set the transmitter's mike-gain control to its normal position for SSB operation, and make any required adjustments in input signal level to the transmitter with R9, the output-level control of the main circuitry. S2 can be momentarily set for continuous output while adjusting R9. On rigs with an ALC indicator, adjust R9 so that ALC activity just starts to occur; otherwise set R9 by whatever method is usually used to adjust the mike gain.

Be sure to use a dummy load out of courtesy to other amateurs. After setting R9, don't forget to return S2 to the pulse position.

With the two-tone signal being fed to the transmitter and the output dissipated in the dummy load, the envelope of the test pattern should be observed on the oscilloscope. Photo D is an example of what the display should look like. Examples of what the pattern should *not* look like can be found in the references as can be additional examples of correct two-tone envelope patterns.[4,6,7,8] If any deviation from the correct pattern can be seen by the naked eye, then the actual level of spurious products has already reached moderate levels.

In other words, by the time the human eye can notice distortion in the two-tone test envelope pattern, actual spurious output products as would be shown by a spectrum analyzer (IMD products as well as insufficient carrier suppression) have already reached an unacceptably high level of −25 to −20 dB down from the PEP output level.[4] Needless to say, if you can see any distortion in the two-tone pattern, adjustment of the transmitter and/or amplifier is necessary. Hopefully, you will be able to obtain the correct pattern of Photo D.

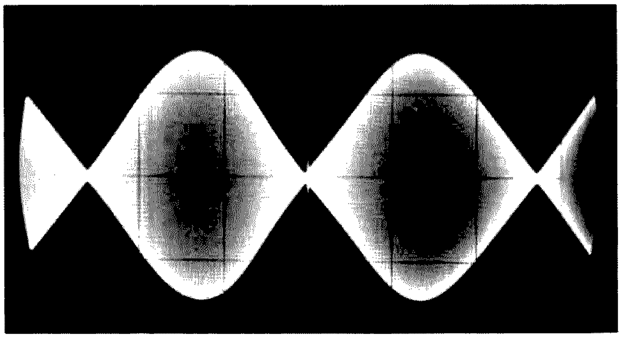


Photo D. Correct two-tone test pattern as displayed by the monitor scope. Coupling was by use of a tee in the transmission line.

Input Power Measurement

If S2 is momentarily set for continuous application of the two-tone test signal and the indicated dc input current is observed, the PEP input current being drawn can be calculated by: I(PEP) = 1.571 × I(dc) −0.570 × I(0), where I(PEP) is the PEP input current, I(dc) is the dc input current indicated by the meter, and I(0) is the resting current drawn by the final with no output signal. Apply the continuous two-tone signal only long enough to obtain the reading, otherwise you might overheat the final amplifier. Also, measure the supply voltage to the final while the continuous two-tone signal is applied. This is necessary because most supply voltages drop significantly under loaded conditions. The product of the loaded supply voltage and the PEP input current then give the PEP input power to the final amplifier under test.

Output Power Measurement

Besides checking for distortion, the oscilloscope is a useful instrument for measuring peak instantaneous output power. Remember that peak instantaneous output power is *not* PEP output power. PEP output power is the rms power of one complete rf cycle occurring during periods of peak modulation when transmitting SSB or under key-down conditions during CW operation. Note that as with other methods of measuring rf power, the transmission line must be properly terminated if accurate measurements are to be obtained.

If a convenient display that fills between 40% to 90% of the screen can be obtained with the direct-connection technique using a normal tee fitting in the transmission line, it is necessary only to calibrate the vertical deflection of the oscilloscope directly in volts per graticule division. PEP output power is then given by: $P = E^2/(2Z)$, where E is the peak instantaneous voltage as measured by the oscilloscope (1/2 of the total pattern height) and Z is the characteristic impedance of the transmission line. Calibration of the vertical-deflection factor can easily be obtained by applying 60 Hz ac to the vertical plates from an appropriate transformer. Be sure to measure the voltage with an ac voltmeter; don't rely on the rated voltage of the transformer. Remember that the voltmeter will almost certainly read the rms voltage, not the peak-to-peak voltage which is what the oscilloscope will display.

If one of the other indirect coupling methods is used, then there will be an arbitrary but constant factor relating graticule divisions to the peak-to-peak rf voltage displayed. One method of determining this calibration constant is to insert a calibrated rf wattmeter into the transmission line and measure the rf power delivered by the transmitter when set for normal CW operation. At the same time, note the height of the pattern on the oscilloscope screen. If the wattmeter reads average or rms power, then the peak instantaneous rf voltage is given by: $E = \sqrt{2PZ}$.

Alternatively, an rf ammeter can be inserted into the transmission line to measure the rms current, and then the peak instantaneous rf voltage is given by: $E = 1.414\ I\ Z$. Remember that these values must be multiplied by two to obtain the peak-to-peak value which represents the full pattern height.

Another method of determining the calibration constant is to measure the rf voltage developed across a dummy load with an rf voltmeter probe connected to a VTVM or other high-input impedance voltmeter; these rf probes usually are set up to measure rms voltage, and this value must be multiplied by 2.828 to obtain the peak-to-peak value.

Conclusion

Once the monitor scope is working properly and, if desired, it has been calibrated for output power, it can be left in the transmission line as a permanent indicator of correct station operation. The pulsed two-tone pattern can be used briefly to tune up the rig for maximum power without distortion, and during speech transmission, the voice-pattern peaks can be examined to be sure they are not exceeding this level. In this manner, peace of mind for the doubting Thomas can at last be obtained. ■

References

1. Goodman, Byron, W1DX, "Linear Amplifiers and Power Ratings," *QST*, August, 1957.
2. Lange, Walter, W1YDS, "A Pulsed Two-Tone Test Oscillator," *QST*, September, 1965.
3. Graeme, Tobey, and Huelsman, *Operational Amplifiers, Design and Applications*, McGraw-Hill, New York, 1971.
4. *Radio Amateur's Handbook*, Chapter 12, ARRL, Newington CT, 57th Edition, 1980.
5. Amidon Associates, 12033 Otsego St., North Hollywood CA 91607.
6. Ehrlic, Robert W., WØJSM, "How to Adjust Phasing-Type SSB Exciters," *QST*, November, 1956.
7. Ehrlic, Robert W., WØJSM, "How to Test and Align a Linear Amplifier," *QST*, May, 1952.
8. Blakeslee, Douglas, W1KLK, "Testing a Sideband Transmitter," *QST*, September, 1965.

Steve Emmons KA0DMT
1408 W. Oak Street
Fort Collins CO 80521

A Scavenger's Radio

Using it is easier than building it.

This little receiver is actually a combination of two other previously-published (and therefore copyrighted) projects. The rf oscillator (Fig. 1) was built from scratch, following the schematic given in one of Radio Shack's "101-in-ONE Electronic Projects" kits. The detector/amp (Fig. 2) was originally described as a "High-Performance Transistor Radio," a souped-up "crystal set" from *Elementary Electronics'* supplementary publication entitled *101 Electronic Projects* ("for under $15—all easy to build"), 1978 edition; the radio was project #12, page 21.

The model I'm using now is a prototype and I'm sure it can use considerable improvement. I discovered quite by accident that holding the oscillator (at that time powered by its own battery) near the JFET radio (which already had its shortwave L_2/L_3 coil) would increase the gain and sensitivity an amazing amount. I suspect it's a regenerative effect, like the old "tickler coil" sets.

I found by experiment that the JFET radio's band coverage could be extended above and below the standard broadcast AM band (550 kHz to 1600 kHz) by using interchangeable coils of different sizes. This was before I added the oscillator. The selectivity is fairly good, and a double-tuned tank using a ganged padder capacitor might improve the selectivity. I described the above combination using the old TV coils because it works so well. Note: the oscillator needs some improvement to remove a tendency to break into audio oscillation at a couple of places on the position of L_1's tuning slug. Otherwise it's an amazing, easily constructed project that many others may find fun to try.

L_1 and L_2/L_3 are recycled coils from a broken TV set. They are slug-tuned with ferrite cores, approximately ¼ inch in diameter on plastic forms. No markings are visible on L_1, but it's wound with very fine enameled copper wire with a winding length of about ⅞ inch and is center-tapped. The two coils on L_2/L_3 have fewer turns and slightly thicker enameled copper wire with the winding interlaced; they were originally soldered together at a pin on the coil's base, making a center-tap, but to isolate the windings I resoldered one lead to an unused pin. L_2/L_3 has the code number TLS-51003.2 063V printed on its base. The distance between L_1 and L_2/L_3 is about 2 inches, but this could be varied.

Both sections of the circuit were built into a plastic box—metal might work better. External input jacks were provided for connecting the antenna and ground. I found out that the receiver actually works better without the ground, however. The circuit is powered by an ordinary 9-volt transistor battery, and the oscillator was left in the sardine can when it was put in the plastic box. Most of the parts were recycled from old TVs and radios. ■

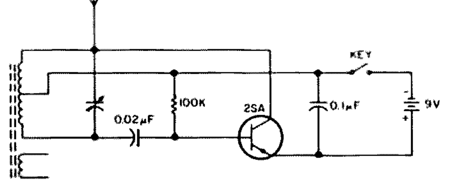


Fig. 1. The original rf oscillator circuit.

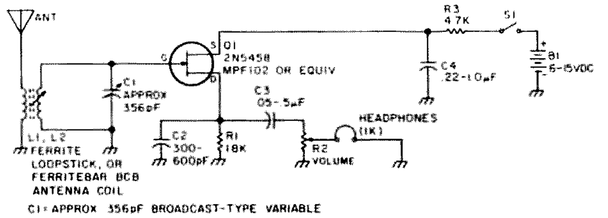


Fig. 2. The detector/amp, here disguised as a transistor radio.

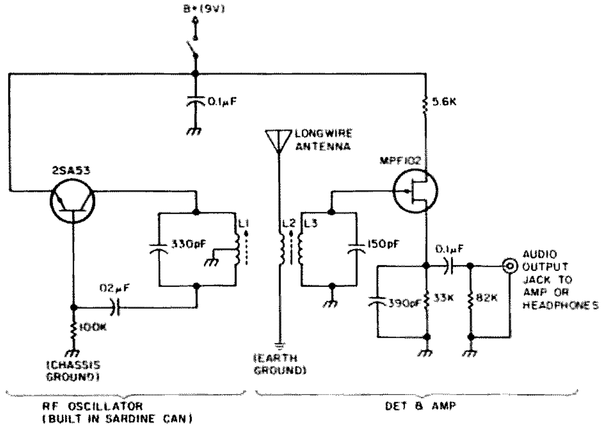


Fig. 3. A simple shortwave receiver. For more fun, use interchangeable plug-in coils.

CIRCUITS

Do you have a technique, modification, or easy-to-duplicate circuit that your fellow readers might be interested in? If so, send us a concise description of it (under two pages, double-spaced) and include a clear diagram or schematic if needed.

In exchange for these technical gems, 73 offers you a one-year subscription (or extension), to be sent upon publication. Submit your idea to: Circuits, Editorial Offices, 73 Magazine, Peterborough NH 03458. Submissions not selected for publication will be returned if an SASE is enclosed.

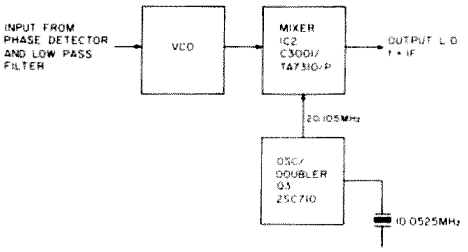


Fig. 1. Block diagram.

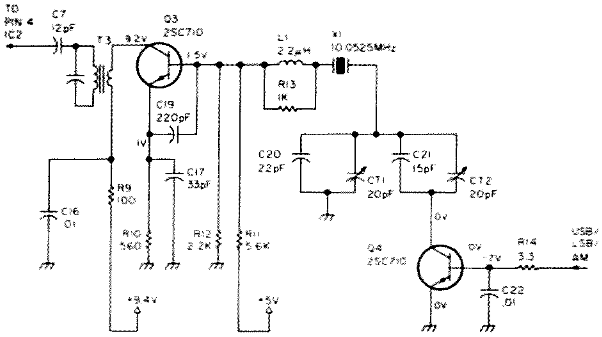


Fig. 2. Unmodified oscillator/doubler.

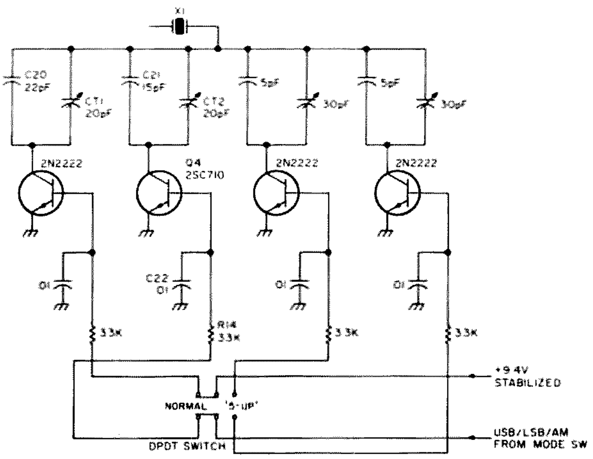
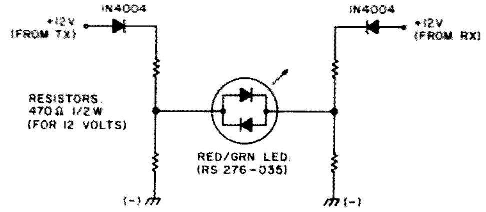
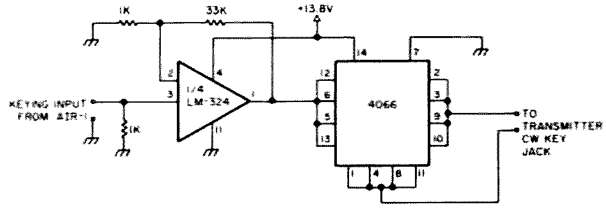


Fig. 3. 5-up modification.

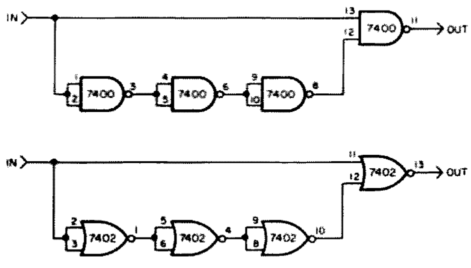
5-UP MODIFICATION FOR CONVERTED CBs: Add 5 kHz to the standard 10-kHz steps of a CB-to-10-meter conversion. Parts on the schematic are numbered according to the Tedelex 6000 or 7000, but other sets such as the Midland 19891 and similar GE rigs have also been successfully modified. Adjust the two new trimmers so that the rig now receives and transmits 5 kHz higher on all three modes. The three new transistors can be any silicon NPN types.—Shawn Barris ZR1EV, Cape Town, South Africa.



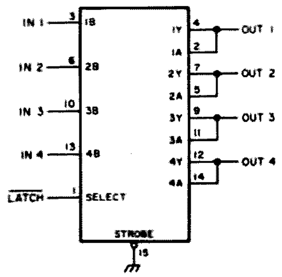
TWO-WAY LED: Here's a little bridge circuit that allows a front-panel LED to glow red or green from a switched positive voltage. Normally you would have to reverse the polarity across the LED, but this circuit does it for you. If your switched voltages are negative with respect to ground, simply reverse the diodes—Ron Johnson WA5RON, Austin TX.



COMPUTER-TO-RIG INTERFACE: I needed a circuit to allow my VIC-20/AIR-1 to key an FT-707, which requires a set of closed contacts such as a straight key. The keying output of the AIR-1 is 0–0.6 V dc, which drives one quarter of an LM-324 op amp. The 13-V output of the LM-324 activates a CMOS switch, keying the rig. The four CMOS switch contacts are wired in parallel to reduce the "on" resistance.—Dave Ball WA4PQD, Barrington NH.



TWO-WAY EDGE DETECTION: When you need an edge-detector for a positive- or a negative-going change and don't want to use a one-shot, try this circuit. Using NAND gates will yield a single LOW pulse when the input goes from LOW to HIGH. Using NOR gates, a single HIGH pulse is generated when the input switches from HIGH to LOW. Any odd number of gates can be used in the delay leg feeding the final gate. The more delay gates used, the longer the output pulse.—Paul Selwa N9CZK, Brownsburg IN.



4-BIT TRANSPARENT LATCH: A fast, reliable, 4-bit transparent latch can be made from the 74157 series of data selectors. The latch is formed by connecting the outputs to their respective "A" inputs and applying data to the "B" inputs. While the select input is high (logic 1), the "B" input data appears on the outputs and on the "A" inputs. When the select input is switched low (logic 0), the output data is held via the "A" inputs until the select line again goes high. If the connections to the "A" and "B" inputs are reversed, this scheme will not work due to the switching delays within the IC. —Paul Selwa N9CZK, Brownsburg IN.

NEW PRODUCTS

Communications Specialists' TR-720 accessories.

TR-720 ACCESSORY CATALOG

Communications Specialists has announced the availability of a complete catalog of all accessories for use with the TR-720 hand-held air band transceiver. Since the TR-720 was first introduced almost two years ago, Communications Specialists has developed a total of 23 different accessories to improve the convenience and utilization of the radio.

For a free catalog, write to *Communications Specialists, Inc., 426 West Taft Avenue, Orange CA 92665; (800)-854-0547 or (714)-998-3021.*

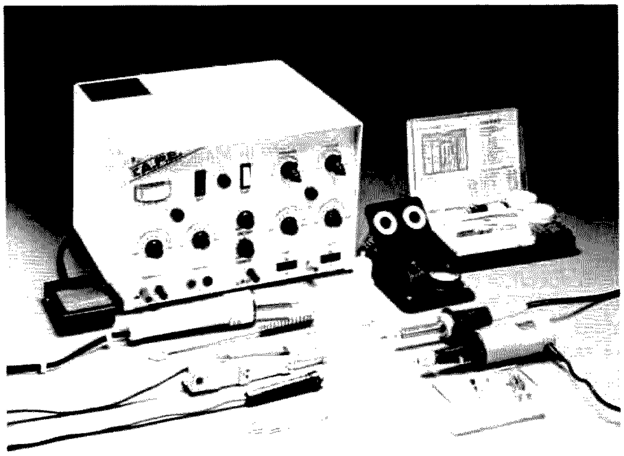
ISO-TIP ELECTRONIC TECHNICIAN DRILL

Wahl Clipper Corporation has introduced a completely redesigned version of its popular ISO-TIP high-speed electronic technician drill. The 13,000-rpm drill features an improved 3-jaw chuck.

The operator can adjust the 3-jaw chuck to virtually any size aperture to accommodate any drill or burr with a shank diameter of up to .125 (1/8").

Weighing less than 5 oz., the drill's compact 6" length allows it to be used in confined areas and within cabinetry. The drill is ideal for prototype development, circuit-board revision and redesign, solder removal, lead hold cleaning, and a variety of other jobs. Burrs, abrasive wheels, or discs can be added to expand the drill's versatility to carve, shape, form, or rout on wood, plastic, leather, and a variety of materials.

For further information, contact *Wahl Clipper Corporation, Sterling IL 61081; (815)-625-6525.*



The A.P.E. PRS-475PG PCB repair system.

LUXOR DOWNCONVERTER

Luxor North America Corp. has introduced the 9726 Low Noise Block Downconverter (LNB) for use with Luxor Block Satellite Receiver Systems. It combines a low-noise amplifier (LNA) and block downconverter in one compact unit. Image rejection at 60 dB minimum and high-frequency stability in block conversion produce low-noise, sparkle-free video. Local-oscillator stability with a very low frequency variance of less than ± 1.5 MHz means high resistance to temperature change.

For more information, contact *Luxor North America Corp., 600 108th Avenue NE, Suite 539, Bellevue WA 98004.*

PRS-475PG

The A.P.E. PRS-475PG is a complete PCB repair system which features a microprocessor-controlled plating center that is capable of depositing 50 microns of gold for mil-spec edge-connector repair. The PRS-475PG also includes a desoldering handpiece, solder iron, thermal tweezer with 3 blade sets, reflow solder tool with practice kit, miniature drilling system, and circuit repair kit. For more information, contact *Automated Production Equipment Corp., 142 Peconic Avenue, Medford NY 11763; (516)-654-1197.*

8-POLE CRYSTAL FILTERS

International Radio, Inc., has announced a 2.1-kHz SSB matched crystal filter set for the TS-940S which consists of one 8.83-MHz 2.1-kHz drop-in 8-pole crystal filter and one 2.1-kHz 455-kHz 8-pole crystal filter (wired in). The matched set provides an overall system selectivity of 2.0 kHz at 6 dB and 2.5 kHz at 60 dB, as well as a shape factor of 1.25.

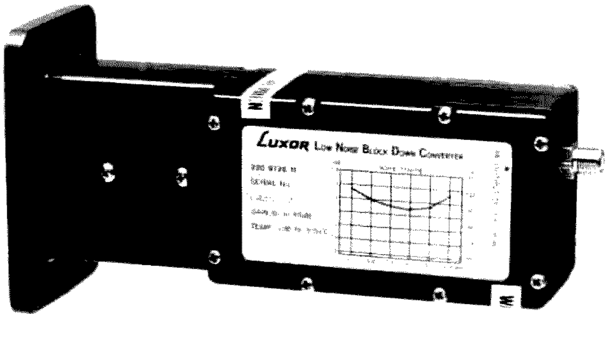
For more information, contact *International Radio, Inc., 364 Kilpatrick Avenue, Port St. Lucie FL 33452; (305)-335-5545.*

PHOTO TRAP SECURITY CAMERA

Mountain West has announced Photo Trap, a unique new security camera that snaps one bright, clear picture when triggered. Any device with a normally open dry contact (motion detector, door contact, holdup switch) can be used to trigger the camera.

Applications include all areas of security: burglary, vandalism, shoplifting, holdup, employee theft, etc. Photo Trap can be used as a stand-alone device or connected into an existing security system. Mounting is easy with the included bracket.

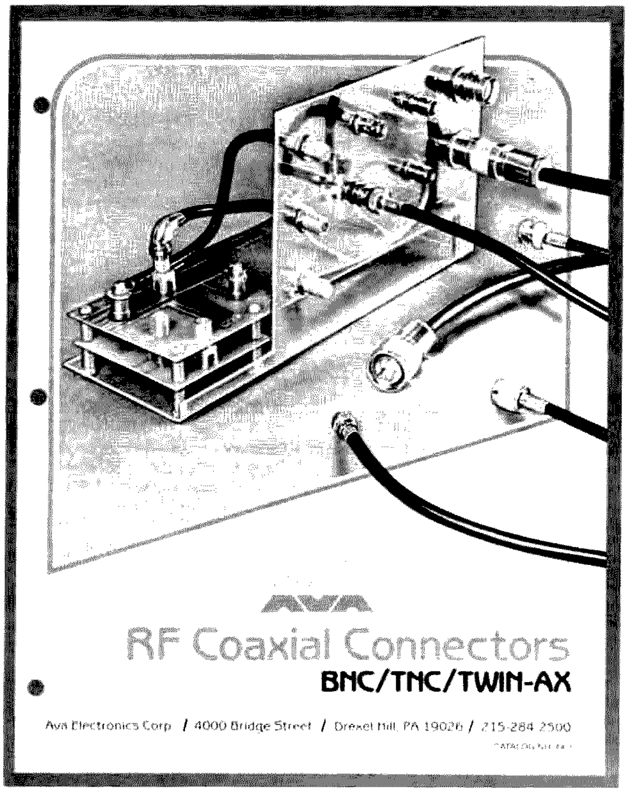
For more information, write *Mountain West, PO Box 10780, Phoenix AZ 85064-0780; (800)-528-6169.*



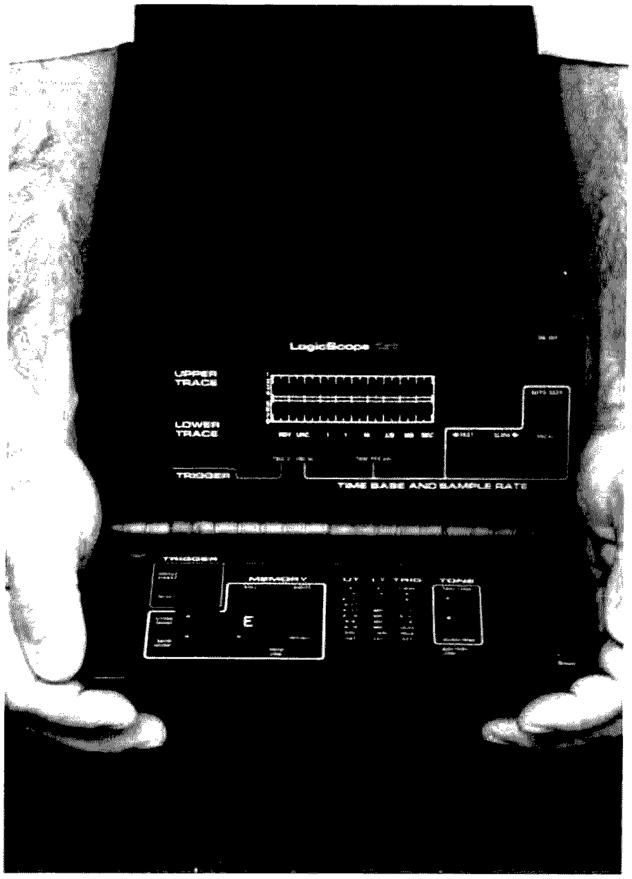
Luxor's 9726 Low Noise Block Downconverter.

The redesigned ISO-TIP high-speed technician's drill from Wahl Clipper Corporation.

Photo Trap, a new security camera by Mountain West.



The RF Coaxial Connectors catalog from Ava Electronics.



The LogicScope 136 from Jensen Tools.

RF COAXIAL CONNECTOR CATALOG

Ava Electronics has announced the new 84-1 catalog which concentrates on BNC, TNC (the newest addition to the line), and Twinax connectors, adapters, and cable assemblies. The catalog includes information on features, materials, and electrical characteristics of the products. UG-type connectors are cross-referenced where applicable. Standard cable assemblies are provided in 3-, 6-, and 12-foot lengths.

The catalog is available to all connector users. For more information, contact *William E. Cooper, Jr., Sales Office Manager, Ava Electronics Corp., 4000 Bridge Street, Dept. S, Drexel Hill PA 19026; (215)-284-2500.*

HAMTRONICS® CVR-900 SCANNER CONVERTER

Hamtronics, Inc., has announced a new converter for scanner radios to cover the 900-MHz land-mobile band. The CVR-900 is an adaptation of the CVR-806 (which covers the 806–896-MHz band). The CVR-900 allows coverage of new services now being assigned or proposed for the 880–960-MHz range, including additional land-mobile services such as police and fire departments, government and non-government fixed stations, industrial, scientific, and medical services, and the proposed 902–928-MHz amateur band. Also included are proposed new cellular telephone and paging services and existing and new broadcast studio-transmitter links.

The unit is equipped with Motorola-type connectors, so it can be simply installed in the coax line from the antenna to the scanner. Dc power for the converter is supplied by many of the scanners, and an ac adapter is available for other installations.

For a complete catalog, including information on scanner antennas, preamps, interference filters, and converters, please send $1.00 to *Hamtronics, Inc., 65-F Moul Road, Hilton NY 14468-9535; (716)-392-9430.* (For overseas mailing, please send $2.00 or 4 IRCs.)

ICOM IC-A2 AIR BAND HT

ICOM has announced the IC-A2 five-Watt PEP output aircraft hand-held transceiver. The ICOM IC-A2 includes all 720 COM and 200 NAV channels *plus* 720 additional COM channels and 200 NAV channels, ten owner-programmable memory channels, internal lithium-cell memory backup, LCD readout, air watch for scanning two key frequencies (with priority lock-on to your primary operating frequency), programmable scanning, frequency lock, a noise blanker, and slide-off battery packs for in-flight charging.

The ICOM IC-A2 comes with an IC-CM7 rechargeable NiCd battery pack, charger, LC-14 soft leather case, and earphone. A wide selection of options and accessories is available, including the ICOM HS-10 headset and HS-10SA VOX unit or HS-10SB push-to-talk switchbox.

For more information, contact *ICOM America, Inc., 2380 116th Ave. NE, Bellevue WA 98004; (206)-454-8155.*

10-MHZ PORTABLE LOGICSCOPE

The LogicScope™ 136 from Jensen Tools, Inc., combines many of the features and capabilities of sophisticated logic analyzers and oscilloscopes. It is lightweight (1.25 lbs.), compact (8.25" × 4.5" × 1.75"), and fast (10 MHz). The instrument was designed for servicing digital electronic circuits and equipment and is especially well-suited for field work.

LogicScope replaces the conventional CRT with an array of 400 LEDs which permits the simultaneous display of two waveforms. It can be operated in real-time or memory mode. Memory mode permits acquisition and storage of up to twenty-four 128-bit waveforms. Waveforms can be recalled and logically compared (AND, OR, exclusive OR) to other stored or input waveforms. An RS-232 port provides for a modem link capability for signal transfers as well as for future expansion features.

The LogicScope features 10 sources for triggering, including free-run, Ch. A, Ch. B, and a trigger channel. A special trigger mode causes the LogicScope to trigger when a difference occurs between the lower and upper trace. Other features include a 50–100-ns glitch catcher, a BNC adapter for simultaneous use of three standard BNC-style test probes, an ac charger/transformer, a neck strap, and a detailed operations manual.

For more information or a free catalog, write or call *Jensen Tools, Inc., 7815 S. 46th Street, Phoenix AZ 85040; (602)-968-6231.*

HAM HELP

We are happy to provide Ham Help listings free, on a space-available basis. We are not happy when we have to take time from other duties to decipher cryptic notes scrawled illegibly on dog-eared postcards and odd-sized scraps of paper. Please type or print your request (neatly!), double spaced, on an 8½" × 11" sheet of paper and use upper- and lowercase letters where appropriate. Also, please make a "1" look like a "1," not an "l," which could be an "el" or an "eye." and so on. Hard as it may be to believe, we are not familiar with every piece of equipment manufactured on Earth for the last 50 years! Thanks for your cooperation.

I need schematics or manuals for an Ameco Model PV preamp, Model CN converter, Model CB-6 converter, Model PS-1 power supply, and a Lafayette HA-225 receiver.

Richard McCubbin WD8RQH
Box 65
Mulliken MI 48861-0065

I am stationed in Japan and always miss sale items. I desperately need an external vfo and speaker for a Kenwood TS-520S. I will pay shipping.

AQ2 David Parks N4KHB/KA2DP
VA56 USS Midway
FPO San Francisco CA 96601

I need a service manual and schematics for a Singer/Gertsch FM-9 service monitor with an FC-3 frequency converter.

Geoff Fors WB6NVH
PO Box 2946
Carmel CA 93921

REVIEW

THE HEATHKIT SW-7800

I've been a ham now for almost 25 years. There's a lot of enjoyment gotten from talking to new and old friends on the ham bands. However, as with any other hobby, a person craves to branch out and expand his or her horizons. In my case, I thought it was time to try shortwave listening again as I had when I first started out. Since all my old shortwave gear is long gone, I needed something new to get back into general-coverage receiving while at the same time not spending a small fortune. Heath's great new SW-7800 general-coverage receiver kit seemed the way to go. I will attempt to explain my trials and triumphs in building this little gem.

Since all my gear is Heathkit I naturally considered them first in purchasing a new rig. They had just introduced their SW-7800 general-coverage receiver and, believe it or not, at a 10% discount. Since the kit price of $349.95 was fairly reasonable to begin with, an extra $35 discount was the clincher.

I realize that more money will buy more sophistication, but my criteria were rather simple: digital readout and digitally-synthesized, 1-kHz resolution or better at a reasonable price with a self-contained power supply, broadband tuning, and CW/AM/SSB capability. FM was desirable but not necessary.

I sent for the instruction manual first to be able to check out construction and schematics. Within 10 days the manual was on my doorstep and 2 days later the order was in the mail.

I deducted the price of the manual when I sent in my order as is customary with Heathkit, but when the kit arrived I found another manual inside the box! However, the enclosed manual had a 12-page correction booklet with it. The changes range from text errors on the circuit boards to replacing whole pages in the instruction manual. A small envelope of parts is packaged loose to be used for replacing incorrect or modified parts. I would imagine that in the future these changes will be incorporated into any revisions.

The first thing that you notice when opening the carton is the careful packaging of the components. There's a sheet of paper just inside the carton that explains how the box is packed and divided into different sections. You are instructed to unpack only the section that is called for in the manual. Each group includes a circuit board, parts, and hardware to complete that section of the manual.

Construction

As is usual with Heathkit, construction is very detailed. Just make sure that you take care of the errata sheets before you begin construction! In addition to the bags of loose parts, there are "taped components." These are the resistors, capacitors, and inductors that are fastened to a tape strip to simplify construction. The components are on the tape strip in the order in which they are used, and Heathkit assures you that when taking parts inventory before construction, it is not necessary to check the taped components because they've been checked at the factory.

Chassis assembly is straightforward. Take your time with the vernier drive mechanism—make sure that the dial cord is wound on the assembly just right. Don't hesitate to wind it over and over again until it's perfect. After all, that tuning knob is going to travel many miles over the life of the receiver and you don't want to cuss at it every revolution along the way!

When assembling the readout circuit board, make sure that the LED digits are in exact alignment. Even though there isn't much error possible when the numerals are inserted into the circuit board, there is enough to make the digits slightly crooked and the job look sloppy. You'll certainly notice it the first time you turn on the rig.

When assembling the controller circuit board, the only precaution to take is the soldering of the vco/vfo/inverter power-supply shields. After the shields are soldered to the board to form a box around the circuits, you are directed to solder the corners of the shields to prevent rf leakage. Since the shields form three sections, the two inner partitions are a little tough to solder. Make sure you have a 35–40-Watt tip on your soldering iron to do the job. The metal shields act as a good heat sink and quickly carry away the heat before a good solder bead has a chance to form.

The receiver circuit board is the largest board in the unit and therefore takes the most time. The components on the tape strip really save time here. Even so, allow 8–10 hours to do the job.

The synthesizer circuit board has the components mounted close together, so be careful of solder bridges. A solder-sucker will clear any solder bridges, but I prefer solder wick (which is simply wire braid) to do the job.

I said earlier that the components on the tape strip were already checked and need not be inventoried again. However, out of habit it's a good idea to check the part against the manual as it is installed. This worked to my advantage on this circuit board because a 0.01-μF glass-ceramic capacitor was substituted for a 0.1-μF unit. A quick check of the parts list, taped component chart, and schematic confirmed that it should be 0.1 μF. I can honestly say this is the first time in my many years of Heathkit building that I've encountered this. A quick check of my parts box produced a suitable 0.1-μF capacitor and I was off and running again. In the meantime, I fired off a warranty claim and 2 weeks later I received the correct value capacitor in the mail.

The matching transformer on the receiver board has to be wound by hand using fine-gauge solid enameled wire and a ferrite core, all supplied, of course. Keep pressing the wires against the core as you wind the turns and you'll have no problem. Be sure to use an object that won't scratch the enamel off of the wires when pressing the wires against the cord.

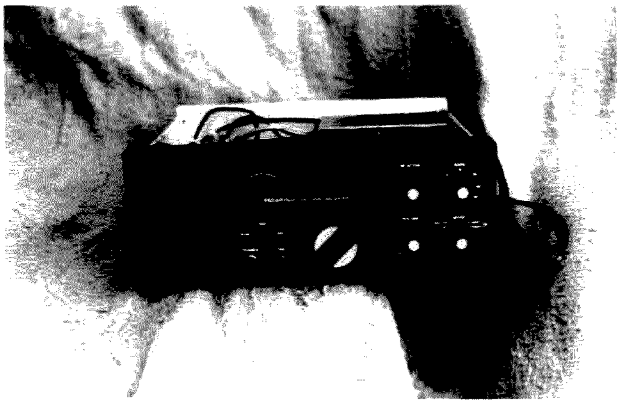
Installing the receiver board is a little tricky. The only real interference is from the ac-input terminal block near the front of the receiver. Keep the line cord, 13-V-dc input cable, line capacitors, and resistors tight against the terminal block and close to the chassis. That way the large receiver board will slip easily into place.

Alignment and Testing

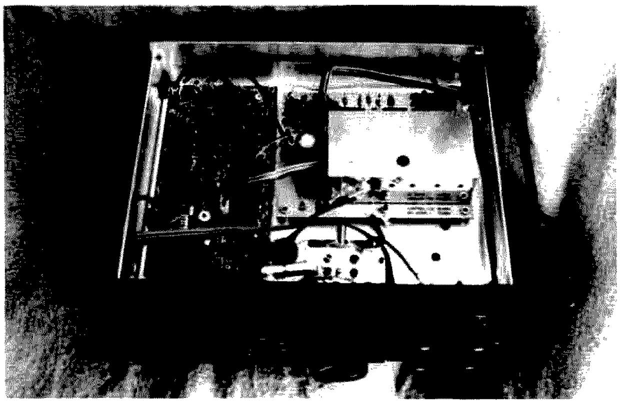
The test and alignment procedure for

Specifications

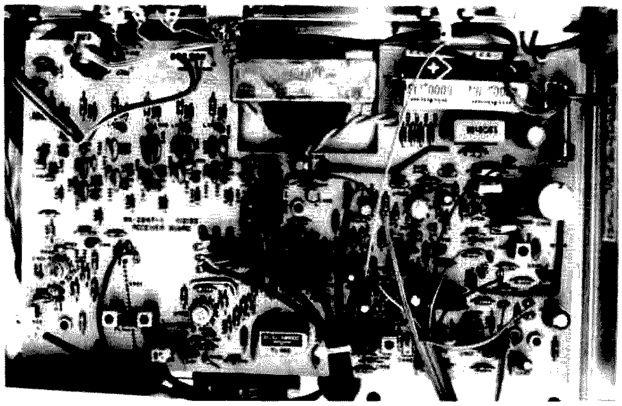
Frequency Coverage:	150 kHz to 30 MHz in 30 1-MHz ranges
Frequency Readout:	Digital, 5 LED digits
Readout Accuracy:	Nearest 1 kHz
Frequency Control:	Synthesized, PLL and LC vfo
Modes:	CW/USB, LSB, AM (wide and narrow)
Sensitivity:	SSB/CW—less than 0.35 microvolts for 10 dB (S + N)/N AM—less than 2.5 microvolts for 10 dB (S + N)/N
Selectivity:	SSB/CW and AM narrow—2.5 kHz minimum at 6 dB AM wide—5.5 kHz minimum at 6 dB
Shape Factor:	1.5 at 6.50 dB
Image Rejection:	55 dB minimum
Dimensions:	11½" W × 10½" D × 4⅝" H
Muting:	External jack for transmitter
Recording:	Miniature phone jack on front panel
Antenna Connections:	SO-239 and Hi-Z
Power:	120 V ac/12 V dc, 11 W
Weight:	About 4½ pounds



Heath's SW-7800 receiver.



Inside the SW-7800. The receiver PC board is mounted below the sub-chassis.



The SW-7800 receiver board. At top right is the dc power supply; the vernier drive can be seen just below FL402.

each board is only a few paragraphs long and consists mainly of adjusting coils and checking voltages. I recommend a digital voltmeter for checking the voltages since it's easy to measure to the nearest one-tenth volt.

As soon as you turn on the receiver for that first alignment check, you should hear background hiss from the speaker. From then on you're home free. After zero-beating against WWV at 10 MHz and adjusting the SSB section of the receiver board, it's just a matter of sitting back and listening to your favorite station.

Conclusion

Heath provides general and detailed circuit descriptions, semiconductor charts, and suggested installation. After several hours of operation, the frequency calibration drifted somewhat and a simple touch up of the frequency trimpot was in order.

I found only two real faults with the rig—both related to portable operation. The first concerns the power cord. If the rig is intended to be taken mobile or for some other reason run off 12 V dc, there is no way to disconnect the ac power cord. I think that a detachable cord would save much aggravation.

The second point concerns transporting the rig. A small handle on the rear panel would be ideal so that the radio can be carried with one hand without fear of dropping it. I might add my own very soon.

Despite these minor drawbacks, I think that this receiver will be very popular. Someone will probably come up with an FM addition for it, and perhaps a modification for 100-Hz readout capability.

Heath has come up with another winner.

To receive more information about Heathkit products, contact *Heath Co., Dept. 150-395, Benton Harbor MI 49022.*

Greg Weiler K3MGQ
Birdsboro PA

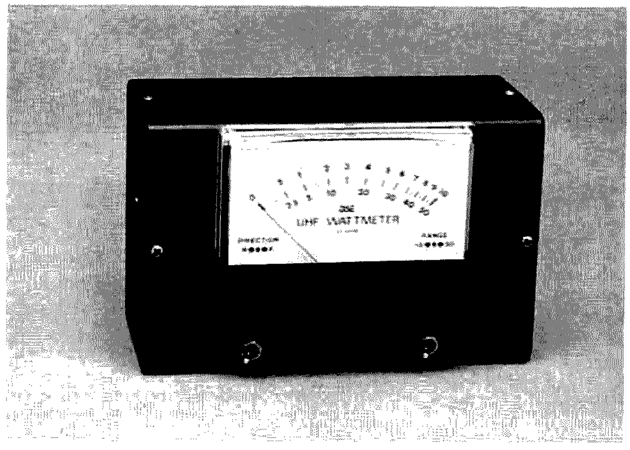
DICK SMITH ELECTRONICS UHF WATTMETER KIT

I'm going out on a limb and predict that one of the best things to happen to electronics in the US this year is the emergence of Dick Smith Electronics, Inc., the California-based arm of Dick Smith Electronics Pty. Ltd. of Australia. This unique company offers a full line of electronic parts, kits, and pre-wired assemblies using a marketing and advertising style that is sort of a cross between the old Poly Paks catalogs and Radio Shack.

According to their sales literature, the company has been in existence since 1968, when Dick Smith started his own two-way-radio service business. Today, it is a multi-million-dollar retail operation, but in typical fashion we here in the US have heard little or nothing about the company. However, that will change—very soon!

Among the many items that DSE carries in their product line are kits of all sorts—test equipment, experimenter's kits, audio amplifier kits, and even a line of introductory kits called "Fun Way into Electronics," which is apparently quite a hit "downunda" (that is, Australia). The development team at DSE apparently scours the amateur publications in VK-land looking for new ideas as well, which brings me to this particular review item—the model K-6312 UHF wattmeter kit which features 10- and 50-Watt ranges.

Shortly after the kit was received here, a call came in from Ike Bain, the President of DSE, informing me that I had been shipped the wrong meter movement for this kit. He thought I had been sent a 100-milliampere movement, when in reality it was a 1-milliampere movement. Regardless, a promise was made to forward a 100-microampere movement, and I set about building the kit.



The Dick Smith Electronics model K-6312 UHF wattmeter.

Dick Smith provides a considerable amount of information with this kit. A long article discussing swr (standing-wave ratio) from *Electronics Australia*'s November, 1984, issue is reprinted as part of the assembly instructions, presumably to give the builder a better idea of what he/she is actually measuring. This is followed by a short article describing the theory and operation of the wattmeter kit, and then the assembly instructions. A parts list and schematic round out the printed materials. (A supplemental folder describes the basics of kit building for the inexperienced.)

This wattmeter is very similar to the type I wrote about in the September, 1984, issue of *73* ("Elementary, My Dear: Watts 'n' Swr"). It uses a stripline transmission line (nominally 50 Ohms) with a pair of coupling lines running parallel to it on either side of the PC board. The one variation from the earlier *73* circuit is another piece of PC board laid across the top of the stripline to act as a shield (similar to a piece of coaxial transmission line). Hewlett-Packard 2800 hot-carrier diodes detect the forward and reflected voltages, which are fed to several trimpots to set the detecting ranges. A 100-microampere meter is used to display the forward and reflected values.

Kit assembly is not complicated and even the most cautious worker can put this together in three hours. All parts are sealed in plastic and there are generous amounts of extra hardware and solder pins for making connections to the PC board. However, the original meter that was shipped had its face held on with sticky tape and the mounting screws were nowhere to be found! This complicated matters when I tried to fit the custom DSE wattmeter scale to the original 1 milliampere meter, and I had to resort to using a thin coat of rubber cement to hold it in place. The subsequent arrival of the correct meter solved the problem, as it had the correct screws with it.

Another tricky aspect of this project is the assembly in and around the enclosure, which is basically a one-piece box with the sides open. These sides are closed with two panels when the project is complete. The final result looks sharp but it makes for a few wiring headaches during assembly. Once the stripline assembly is complete, it is then fastened to a tinned shield plate and attached to two BNC-type connectors on the rear panel. The top shield PC board is then fastened with two nylon screws. At this point, you are advised to solder the edges of the stripline board to the tinned shield plate *through* the meter hole in the box. This is quite tricky if you want to get a good soldered edge all the way around the board.

I would suggest using a chisel tip for your iron to do this job since there isn't a lot of room to maneuver around. Also, you have to install the front-panel switches and then solder their associated PC boards to their terminals to make sure they line up correctly. This is detailed in the instructions. Finally, securing the meter itself to the front panel requires dexterity with a socket from a drive set, since the clearance will not allow for a drive handle. Using pliers to tighten these small nuts is cheating and won't provide the secure fit necessary!

To summarize construction: The assembly manual is straightforward but the technique is unusual. It can be accomplished by the novice builder, although having small agile fingers helps in a few cases.

Now to the nitty-gritty. How well does it work? A test setup was made using a short piece of Belden 8214 from a Microwave Modules 432-28S transverter. This in turn fed the DSE wattmeter, and then, using adapters, a Bird Model 43 coupler was attached to the output of the DSE wattmeter and terminated in a Bird Termaline 50-Watt coaxial resistor. The MMT 432-28S normally puts out 10 Watts when driven by a Kenwood TS-430S.

Both forward and reflected ranges were calibrated against the Bird. To ensure the highest accuracy, calibrations were made at mid scale on both meters (i.e., 5 Watts). Additionally, measurements were made with the Bird before the DSE wattmeter to verify its claimed 50-Ohm impedance rating. The displayed-power comparisons were as follows:

Bird Model 43 (Watts)	DSE UHF Wattmeter (Watts)
1	.75
2	1.75
3	3
4	4
5	5
6	6
7	7
8	8.25
9	9.5
10	Off scale

Not bad! The next step was to check the 50-Watt power range. A 100-Watt slug was put in the Model 43 and the range switch on the DSE wattmeter was set to 50. Calibration was made at mid scale—in this case, 30 Watts on the DSE, which is slightly less than mid scale on the Bird 43. Measurements were made at five different power ranges using the same coaxial resistor and throttling back a Mirage D1010 amplifier's output to obtain the desired power levels. The displayed-power comparisons were then as follows:

Bird Model 43 (Watts)	DSE UHF Wattmeter (Watts)
10	12.5
20	22
30	30
40	40
50	50

Again, very respectable. The inaccuracies at the high and low ends are not unexpected. Bird claims only 10% accuracy of full scale, especially on lower-power readings. The next question was "If this was indeed a 50-Ohm instrument, what would stop me from using it on 220 MHz and even 144 MHz?" (except for recalibrating the range pots). The answer is that it really isn't a 50-Ohm instrument, but that doesn't surprise me. Many of the boards I tested for the earlier *73* stripline wattmeter showed inconsistencies from batch to batch in this regard.

In summary, the Dick Smith Electronics UHF wattmeter kit is a well-designed, good-looking piece of test equipment. It can fill a need for the more serious UHF enthusiast and is relatively simple to construct using mostly conventional techniques. Ample documentation is supplied with the kit to ensure success. In addition, DSE supplies a "Sorry, Dick—It won't work" coupon to allow for repairs by a DSE facility. Additional coupons allow for a calibration procedure by DSE using a Bird Model 43 for a nominal sum. The kit sells for $44.95 plus shipping and handling.

One additional note: Try to obtain the latest DSE flyer. This has to be the funniest direct-mail piece I've read in a long time. I can hardly wait for the catalog to show up!

For more information, contact *Dick Smith Electronics, Inc., PO Box 2249, Redwood City CA 94063.*

Peter Putman KT2B
Morris Plains NJ

WHAT DO *YOU* THINK?

Have you recently purchased a new product that has been reviewed in *73*? If you have, write and tell us what *you* think about it. *73* will publish your comments so you can share them with other hams, as part of our continuing effort to bring you the best in new product information and reviews. Send your thoughts to Review Editor, *73 Magazine*, Peterborough NH 03458.

THE SEIKO DATA-2000

As amateur-radio operators, we have a unique habit of exploiting the capabilities of a variety of electronic equipment. From modifying a surplus radio to converting a CB transceiver for ten-meter use, we are constantly adapting and applying technology to meet our needs. However, not all equipment requires modification to be useful. A perfect example of this is the widespread use of microcomputers in the ham shack to handle the laborious task of log keeping, QSLing, and other paperwork. A new piece of equipment which I have

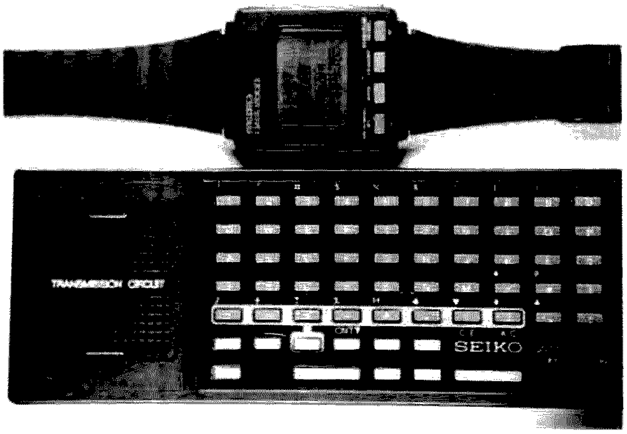
found to be useful in many amateur-radio applications is the Seiko Data-2000 wristwatch system.

The Seiko Data-2000 is a computerized wristwatch which includes a wrist unit and a keyboard. The wrist unit looks and wears like a regular watch. It displays the time (hours-minutes-seconds), date (month-day), and has an alarm and a stopwatch. The watch also features an additional function which makes it one of the most powerful watches available: a nonvolatile 2000-character memory in which any text can be stored after being input via the keyboard unit.

The watch's memory is divided into two areas (labeled A and B) of 1000 characters apiece. Each memory can be recalled and viewed on the watch's 10-character-by-4-line LCD display. The memory can be scrolled up or down, displaying 40 of the 1000 characters at any one time.

Data are input to the watch from the keyboard via a special transmission circuit which utilizes an inductive method similar to that used in wall transformers. The watch and the keyboard unit each contain a matching coil. When data are transmitted from the keyboard to the watch, a magnetic field generated by the keyboard's coil cuts across the coil in the watch, generating a current in the watch's coil. This current switches on and off to transmit the digital information. This method of transferring the data allows the watch to remain sealed and eliminates the need for cables and other wires.

The wristwatch measures 3.5 cm wide by 4 cm long by 1.2 cm thick with aluminum and stainless-steel construction. The band is adjustable and is also stainless steel. The watch is entirely black, with the exception of the silver back, the gold lettering, and the buttons.



Seiko's Data-2000 wristwatch.

Directly beneath the LED display are four buttons. The first button, starting from the left, is used for clearing the stopwatch, setting the time and date, and scrolling up through memory. The next button in line is used for selecting the mode, whether it is time and date, memory A or B, the alarm, or the stopwatch. The transmit button is used for initiating the transfer of data from the keyboard. The last of the four buttons is used for starting and stopping the stopwatch, setting the time and date, and scrolling down through memory.

The keyboard features a 81-key QWERTY layout along with cursor-control keys and various special symbols. To communicate with the watch, the back of the watch must first be placed on a section of the keyboard labeled Transmission Circuit. Once the keyboard is turned on and the transmit button on the watch is pressed, the watch is ready to receive data. From the keyboard, memory A, memory B, or a calculator mode may be selected.

If one of the memories is chosen, any data typed on the keyboard will be transferred to the watch's memory. There are several special symbols, such as a telephone and an airplane, which can be used as a heading to conserve space. The calculator mode allows simple arithmetic (addition, subtraction, multiplication, and division) to be performed and displayed on the watch's display.

This powerful watch's many capabilities can be applied in a number of amateur-radio applications. Imagine going to a hamfest with a complete list in memory of all that you are looking for, from tubes and other parts to the back issues needed to complete your magazine collection. A portable logbook, a repeater directory for your next trip, and skeds complete with names, calls, dates, and frequencies are all useful information that could be stored in the watch for instant recall.

This watch represents the incredible advances in solid-state technology that have been made over the past several years and makes one wonder what the future holds. It is wonderful fun to use and I'm still coming up with new applications for it. While its list price of $195.00 may discourage some potential buyers, recall the calculator revolution in which the price of calculators dropped by several hundred dollars over the course of a few years. A similar drop in the price of the watch can also be expected as its technology becomes commonplace; even today, the watch can be found discounted well below list price.

Once you start using this watch, it is difficult to get along without it. And one thing is for certain—its applications are limited only by the imagination of the user.

For more information, contact *Hattori Seiko Co., Ltd., 6-21 Kyobashi 2-Chome, Chuo-ku, Tokyo 104, Japan.*

Jonathan Mayo KR3T
Media PA

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

For many years, whenever I was asked for a simple circuit for a RTTY AFSK generator, I referenced a one-transistor wonder that I wrote about in an article in *73* several years ago. I liked this particular circuit because, although it used the familiar 88-mH toroid coils once so ubiquitous in amateur RTTY, it was relatively straightforward to build and simple to adjust. The only thing I didn't like about it was that the waveform was not a true sine wave, so using it on SSB to generate HF RTTY was out. But the circuit was designed for VHF AFSK links, and there it did well. And these days finding those toroids, which used to be five-for-a-dollar and in every ad and on every table at hamfests, has become nearly impossible.

Well, sorry, old buddy, but I have a new favorite. As I mentioned last month, these two cuties caught my eye while I was strolling through my local Radio Shack in Towson. Not salesgirls, although they are not bad either, the two in mind are chips of particular interest to the RTTYer. Last time I talked about the XR-2211 phase-locked loop as a basic demodulator, so this month let's have a go at the XR-2206 function generator.

This little cutie, marketed under Radio Shack's stock number 276-2336 and sold for six bucks or less (on sale), is a stable source of frequencies in the range of fractions of a Hertz to one megahertz or more. All it takes is a few passive components, that is, resistors and capacitors, and you are ready to roll.

An AFSK generator which puts out high-quality sine waves at standard (or non-standard, for that matter) amateur RTTY frequencies is shown in Fig. 1. A few words of explanation are in order. First of all, the +Vcc for this chip is 10 V dc, not five, as with common TTL chips. The RTTY keying voltage is fed to pin 9, referenced to ground, and should show a swing from less than one volt to more than two volts. We will look at how that is accomplished in a second. Next, the two audio frequencies are determined by the combination of the capacitor between pins 5 and 6, which should be a stable 0.01-uF capacitor (not a plain garden-variety disk—these often show far too much drift), and the resistors going to ground from pins 7 and 8.

The frequency generated by a high-level signal on pin 9 is determined by the resistor on pin 7, and the frequency generated by a low-level signal on pin 9 is determined by the resistor on pin 8. The relationship is determined with the formula f = 1/(R × C). So, with a 0.01-uF (0.00000001-F) capacitor and a 45000-Ohm resistor, a frequency of approximately 2200 Hz would be generated. That is why I show 50k-Ohm potentiometers for the two frequency-determining resistors. You could certainly use a fixed resistor and potentiometer combination (such as a 30k-Ohm resistor and a 25k-Ohm potentiometer in series) to allow finer adjustment over a more narrow range; it's up to you.

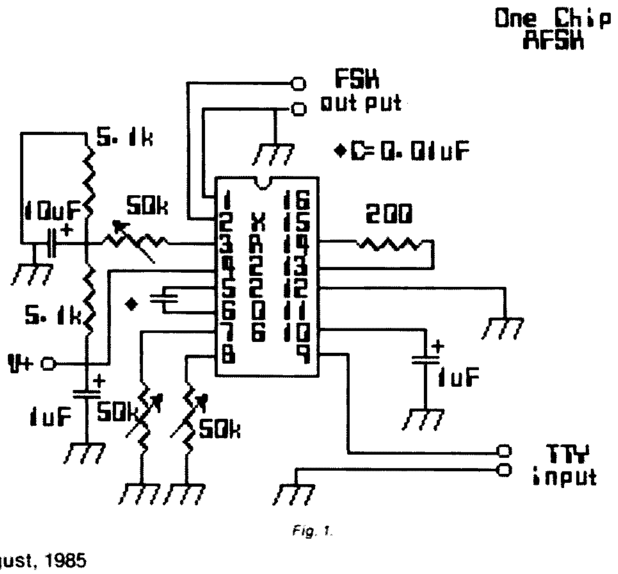


Fig. 1.

So far I have avoided calling either frequency mark or space, and with a good reason. It will depend how you are keying the circuit. If you have a setup where a positive voltage represents mark, and either ground or a negative voltage represents space, then the mark frequency will be determined by the resistor on pin 7, and the space frequency by pin 8. However, if you are keying this with an (pardon the expression) "RS-232" voltage level, then the mark will be a negative voltage, and the space a positive, and the situation is reversed! In that case, use the potentiometer on pin 8 to set the mark, and pin 7 to set the space.

I mentioned that this circuit is not bound to the "standard" RTTY frequencies, and I meant that. Although I am sure many of you will be setting up for mark = 2125 Hz and either 170-Hz shift (space = 2295 Hz) or 850-Hz shift (space = 2975 Hz), there is no reason in the world to feel that those frequencies are engraved in stone if you will be feeding the signal through an SSB transmitter to produce HF FSK. So, for example, you may choose to use a frequency closer to the midpoint of the audio passband, like 1600 Hz for mark and 1770 Hz for space; it all depends on you. (Hmm... sounds like a song cue!)

Let me see—what else can I tell you?

Oh, that the potentiometer connected to pin 3 controls output amplitude. My specs tell me that you will get about 60 mV of output for every kilohm of resistance, so with a maximum of 50k Ohms, you should be able to get about 3 volts peak to peak, more than enough to drive your transmitter, I would think. Of course, you will need some kind of standard to set this thing on frequency, which can range from a frequency counter—they're getting so cheap now that it is hard to imagine being without one—to a well-calibrated demodulator. Then again, if you are building a demodulator as well and have no standard, then we can get very Einsteinian and speak of relative frequency and motion, but better you should find a buddy with a standard you can anchor to.

Good luck—with this circuit, and the one shown last month, you should be able to get onto RTTY on a shoestring without too much trouble—assuming you have a terminal of sorts, of course. But that is a topic for another column!

I have a letter here from Jim Engelen WD0BIE, in Mankato MN, who is using a CoCo on RTTY and writes of being told that he is "upside down" when transmitting on HF. Well, Jim, there are at least two possible reasons for this happening. The first is related to the manner of keying, as discussed above. Various keying circuits interpret mark and space differently, and if you are generating a positive voltage for mark and feeding it to an RS-232 input which expects a negative, well you get the picture. The solution is to change the way you are generating the voltage, if possible, or read the next problem and its solution and try that.

The other reason for this happening is if you were transmitting on the "wrong" sideband. Let's see why this happens. Starting out with the desired HF signal, recall the old saw, printed here many moons ago: LSMFT—Low Space Means Fine Teletype. Now I know that to you younger folks these letters mean nothing, but trust me, they have been an effective mnemonic until recently. However, the standard on AFSK is to have, as I mentioned above, a low mark frequency and a high space. Now, if you transmit on lower sideband, the frequency transmitted is the difference of the center frequency minus the audio frequency. So, a higher audio tone for space will result in a lower rf space frequency. However, if you are transmitting on upper sideband, the audio tones are not inverted and you will be transmitting upside down from the normal HF convention. This becomes a problem with some HF rigs which automatically select the sideband based on the conventional sidebands used per band. So, on ten meters, where upper sideband is usually used, these transmitters will transmit RTTY upside down, if used in the "normal" way. The solution is to switch sidebands, if you can. If you can't, then you have to go back and swap mark and space somewhere else in the system, either in the way you are keying the transmitter, with an inverter, or in the software you are using, if it is capable of doing that. Let me know how things work out.

Regards to another CoCoNut, Bob Billson KC2WZ, of Westfield NJ. Bob is looking for a program to use his CoCo on TDD systems to communicate with the deaf. Such a program is available in the CoCo SIG on CompuServe. This brings up the side topic of what to do with your old machines when you computerize. I don't know how many of you are aware of the use of Murray machines by the deaf, but I'm sure that many of you have seen this or that public-service agency print a special telephone number detailed either as TTY, whose meaning is obvious, or TDD, which stands for TTY Device for the Deaf. If you have an older Model 15 or the like lying about, why not contact a local agency and see if it could not be put to good use serving the needs of the hearing-impaired in your community. Public service is not always on the air, you know.

I had hoped to print some photos of this year's Greater Baltimore Hamboree and Computerfest, sponsored by the Baltimore Amateur Radio Club, in this month's column. Unfortunately, those photos, along with a smashing one of my youngest, remain lost within the bowels of Eastman Kodak, somewhere between here and Rochester. Hopefully I will have them back in time for next month. I think you will enjoy them.

Several of you have forwarded comments to me complaining of poor response by a number of suppliers of RTTY programs and equipment. I have sent these letters on to the respective manufacturers, and some of them have been answered. About all I am willing to say at this point in time is that if you have written to me complaining of a problem and that problem has still not been solved, please drop me another note. The companies' concerned responses are praiseworthy; I only hope that they represent actions, not words alone.

The files are also filling up with information on many more RTTY programs for the various personal computers that I knew existed. I think you will enjoy the list being put together and perhaps find new avenues to explore. It's never too late to let me hear from you with your opinion on this piece of software or that piece of hardware. I am trying to keep a current list, which shall join the other reprints available from this column to be available from this address. *Not yet*, though! Wait until the first edition is published in this column. It just might answer all your questions.

As always, I remain reachable at CompuServe ID 75036,2501, via E-Mail or on the CoCo SIG. Feel free to drop me your comments there as well as in the mail at the above address. If you have a question that is too involved to send on E-Mail, but the answer could be sent that way, include your ID in your letter and I will try to send the answer electronically. I aim to please.

Stay tuned to the next few months as we look at as many ways to get on RTTY as we can, trying to avoid high-ticket items if at all possible. I enjoy your input, and from that input I know you enjoy my output, right here in "RTTY Loop."

SATELLITES

USING THE AO-10 APOGEE PREDICTIONS

Apogee predictions for the month of August are provided for three sections of the United States: Washington DC at 39N 77W, Kansas at 39N 95W, and California at 38N 122W. Times are in UTC and apogee in this case is mean anomaly 128 rounded to the nearest whole hour. Use the chart as a guide in aiming your antenna, then fine-tune the azimuth and elevation values to peak the satellite's beacon signal. If you require more accurate orbital predictions, contact AMSAT at PO Box 27, Washington DC 20044.

AMSAT-OSCAR 10 APOGEE PREDICTIONS
AUGUST 1985

			WASH		KANSAS		CALIF	
ORBIT	DAY	TIME	AZ	EL	AZ	EL	AZ	EL
1935	1	1100	238	4	224	16	197	28
1937	2	1000	230	12	214	22	183	31
1939	3	0900	221	20	202	28	169	31
1941	4	0900	215	20	195	27	164	27
1943	5	0800	203	26	182	29	151	25
1945	6	0700	191	30	169	30	139	20
1947	7	0700	184	27	163	26	136	15
1949	8	0600	171	28	150	23	126	9
1951	9	0500	157	27	139	19	117	2
1953	10	0500	152	22	135	14	115	0
1955	11	0400	141	18	126	8		
1957	12	0300	130	13	117	1		
1959	13	0300	128	7				
1961	14	0200	119	1				
1962	14	1300					243	3
1964	15	1300					237	5
1966	16	1200					229	13
1968	17	1200					223	14
1970	18	1100			236	5	213	21
1972	19	1000	241	1	228	13	202	26
1974	20	0900	234	9	218	20	189	30
1976	21	0900	228	11	212	20	182	28
1978	22	0800	219	18	200	25	169	28
1980	23	0800	212	18	194	24	163	24
1982	24	0700	201	23	181	26	151	22
1984	25	0600	189	27	168	26	140	17
1986	26	0500	176	28	155	24	130	12
1988	27	0500	170	25	151	20	127	6
1990	28	0400	157	23	140	16	119	0
1992	29	0300	145	20	130	10		
1994	30	0300	142	15	127	5		
1996	31	0200	132	10				

BARTER 'N' BUY

Individual (noncommercial) ....25¢ per word
Commercial ....60¢ per word

Prepayment by check or money order is required with your ad. No discounts or commissions are available. Please make your payment to *73*. Rates for multiple insertions are available on request.

Advertising must pertain to amateur radio products or services. No special layouts or positions are possible. All advertising copy must be submitted typewritten (double-spaced) and must include full name and address. Copy limited to 100 words, maximum. Count only words in text. Address, free.

73 cannot verify advertising claims and cannot be held responsible for claims made by the advertiser. Liability will be limited to making any necessary corrections in the next available issue.

Copy must be received in Peterborough by the 5th of the second month preceding the cover date.

Make checks payable to *73* Magazine and send to: Ross Kenyon, Advertising Department, *73* Magazine, 80 Pine Street, Peterborough NH 03458.

MOBILE IGNITION SHIELDING. Free literature. Estes Engineering, 930 Marine Drive, Port Angeles WA 98362. BNB006

MILITARY TECHNICAL MANUALS for old and obsolete equipment. 60-page catalog, $3.00. Military Technical Manual Service, 2266 Senasac Ave., Long Beach CA 90615. BNB045

NEW HAM-SWL SOCIETY for unity of thought & learning. Open to all. Many topics, awards, free ad space in periodical, society net, museum participation. Shack pics & QSLs welcome. Writers needed. SASE for info to RCSW, 32 Applegate, Bennington VT 05201. BNB197

THE DX'ERS MAGAZINE. Up-to-date, informative, interesting. Compiled and edited by Gus Browning W4BPD, DXCC Honor Roll Certificate #4. Send for *free* sample and subscription information today. PO Drawer DX, Cordova SC 29039. BNB261

CASH PAID for traffic/speed radar equipment. Write or call: Brian R. Esterman, PO Box 8141, Northfield IL 60093; (312)-251-8901. BNB271

COPY SATELLITE PHOTOGRAPHS, weather maps, and press on our military-surplus facsimile recorders. Recorders are solid-state, dual-speed, and fully automatic. Catalog available. Atlantic Sales, 3730 Nautilus Ave., Brooklyn NY 11224; (718)-372-0349. BNB280

$$$$$ SUPER SAVINGS on electronic parts, components, supplies, and computer accessories. Free 40-page catalog for SASE. Get on our mailing list. BCD Electro, PO Box 830119, Richardson TX 75083; (214)-690-1102. BNB289

ATLAS 350XL OWNERS GROUP. Free newsletter. Send QSL with rig s/n and SASE. Know people who repair them? Information to share? Questions? Rod N5NM, Box 2169A, Santa Fe NM 87501. BNB291

1985 "BLOSSOMLAND BLAST," Sunday, October 6, 1985. Write "BLAST," PO Box 175, St. Joseph MI 49085. BNB296

FIND OUT what else you can hear on your general-coverage transceiver or receiver. Join a shortwave radio listening club. Complete information on major North American clubs and sample newsletter, $1.00. Association of North American Radio Clubs, 1500 Bunbury Drive, Whittier CA 90601. BNB310

CX7 REPAIRS. Mark Mandelkern, 2315 Derby St., Berkeley CA 94705; (415)-549-9210. BNB320

DX ADVENTURE on Montserrat, only $250/week. Details: Chod Harris VP2ML, Box 4881-7, Santa Rosa CA 95402. BNB321

IMRA—International Mission Radio Association. Forty countries, 800 members. Assists missionaries with equipment loaned, weekday net. 14.280 MHz, 2:00-3:00 pm Eastern. Brother Bernard Frey, 1 Pryer Manor Road, Larchmont NY 10538. BNB326

FREE: 100 QSLs with first order. Samples 50¢. Gazebo Press, Rt. 4 Box 4148, LaPlata MD 20646. BNB327

ELECTRON TUBES: receiving, transmitting, microwave . . . all types available. Large inventory means next-day shipment in most cases. Daily Electronics, PO Box 5029, Compton CA 90224; (213)-774-1255. BNB330

WANTED: radios, tubes pre-1939 for my collection. Howard Stone, HCR-3, Box 418, Deer River MN 56636. BNB332

CODE-PRACTICE PROGRAMS diskette for IBM PC, PC/jr. $10.00 ppd. Andrew Modla/73/N3EGH, 5 Derby Place, Newtown PA 18940. BNB334

HAM TRADER YELLOW SHEETS, in our 24th year. Buy, swap, sell ham-radio gear. Published twice a month. Ads quickly circulate—no long wait for results. SASE for sample copy. $10.00 for one year (24 issues). PO Box 356, Wheaton IL 60189. BNB335

QSL CARDS—50 for $5.00 and 100 for $8.00, postpaid. Kenneth Hand WB2EUF, PO Box 708, East Hampton NY 11937. BNB336

COMMODORE Authorized Service Center, 24-hr. service. WA2AJQ, 303 S. Vermont Ave., Royal Oak MI 48067; (313)-399-3990. BNB337

START COPYING CW THE EASY WAY! Learn to copy code like the pros! Gain on-the-air confidence quickly! Easy-to-learn word-recognition system for the ham who already knows the code. 14-day money-back guarantee. Order the OSO-Trainer™ Code Course. Send $14.95 + $2.00 shipping and handling (IN residents add $0.85) to AVC Innovations, Inc., Dept. 7C, PO Box 20491, Indianapolis IN 46220. BNB338

MORSE-CODE TAPES AND RECORDS, Heathkit code oscillator $10.00, dc electronics course $25.00, old tubes, unused Motorola CB and antenna $75.00, three old FM transceivers, miscellaneous electronics parts. Make an offer. Call (301)-937-0286 (Beltsville MD). BNB346

RADIO TRANSCRIPTION DISCS WANTED. Any size, speed. W7FIZ, Box 724—WG, Redmond WA 98073-0724. BNB347

RADIO OFFICER WANTED: FCC and USCG licenses and 6-month endorsement required for sea-going employment. Excellent money and fringes for technically qualified person. Send resume and copies of licenses to: Box NH 2493, 810 Seventh Ave., New York NY 10019. BNB348

CABLE CONVERTERS. Lowest price. Dealer inquiries accepted. Quantity discounts. Free catalog. P.G. Video Corp., 61 Gatchell St., Dept. 73, Buffalo NY 14212. BNB349

ANTIQUE RADIOS, schematics, tubes, and literature. Send $1.00 to VRS(ST), 376 Cilley Rd., Manchester NH 03103, for a large catalog. BNB350

TOO MANY MICROPHONES on your operating desk? With the SISCO model 612 mike control you can now use one microphone with several rigs. Prices start at $15.95. Southern Instrumentation, PO Box 5097, Ormond Beach FL 32074; (904)-673-1059. BNB351

COCO SOFTWARE by dataLOG! Comprehensive logbook program, DXCC/WAS database, CoCo Morse w/interface, disk utilities. Write or call for free catalog. dataLOG Software, WA4FNG, PO Box 10531, Jacksonville FL 32247; (904)-396-6572. BNB352

REPLACE RUSTED ANTENNA BOLTS with stainless steel. Small quantities, free catalog. Elwick, Dept. 554, 230 Woods Lane, Somerdale NJ 08083. BNB353

3-500Z, $70.00 each plus shipping, 50-year collection of tubes. W5QJT, PO Box 13151, El Paso TX 79913; (915)-532-2509. BNB354

MOVING TO CENTRAL FLORIDA? Beautiful QTH, minutes from Disney World, 2,700 air-conditioned square feet, lovely half-acre wooded lot, prestigious neighborhood. Three bedrooms, two baths, fireplace, sophisticated ham shack, game room, screened porch, sun deck, separate matching 600-square-foot utility building (ideal for workshop or in-law suite). Furnishings possible. Includes 160' Rohn 45G construction tower, Wilson 5-element monobanders (10, 15, and 20 meters), inverted-V dipoles (40 and 80 meters), 13' Earth-station satellite system. Many other amenities. Superlative QTH for retiring radio amateur. $175,000, terms negotiable. For information, pictures, etc., call Don W4JTK, (305)-298-3116, or write (address OK in *Callbook*). (Moving to $300,000 home next door!) BNB355

WANTED: schematics for Motorola U43GGT tube-type VHF police transceiver. Emil Kubanek W8BVR, 6298 Old Allegan Road, Saugatuck MI 49453. BNB356

COMMODORE 64 CW INSTRUCTOR PROGRAM. Generates CW on TV speaker. Random code, keyboard input, or prerecorded "CW Tests." Character speed and spacing set independently. Designed for classes and increasing code speed. $15.00—diskette or cassette (specify). Dennis Olver N7BCU, 22000 S. Tonya Ct., Beavercreek OR 97004. BNB357

9Q5GB: My logs show thousands of unclaimed QSL cards from contacts in 1978 from Africa. To claim yours, send QSL and $2.00 to: 9Q5GB, PO Box 193, Firestone CO 80520. BNB358

HAMSWAP newsletter—now taking free ads. Buy/sell/trade, plus equipment discounts. Must include phone. 12 issues $9.00. *HamSwap*, PO Box 420171, Sacramento CA 95842. BNB359

KT6B ANTENNA, 160m-10m, no traps, $59.95. Weather-boot kit, $8.95. Open-wire feedline, roller inductors, antenna accessories, and much more! Kilo-Tec, PO Box 1001, Oak View CA 93022; (805)-646-9645. BNB360

SPECIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices, 73 Magazine, Pine St., Peterborough NH 03458.

KALAWAO COUNTY HI
JUL 25-28

The Kauai Amateur Radio Club will operate station KH6F from Kalawao County, a leper settlement on the island of Molokai, on July 25-28, 1985. Operation will be on 80, 40, 20, 15, 10, and 2 meters using SSB, FM, and CW. To QSL, send an SASE (or SAE and IRC) to KH6F, PO Box 675, Koloa HI 96756.

OKLAHOMA CITY OK
JUL 26-28

The Central Oklahoma Radio Amateurs (CORA) will sponsor Ham Holiday 85 (HH 85) and the ARRL Oklahoma State Convention on July 26-28, 1985, at the Lincoln Plaza Inn, Oklahoma City OK. Pre-registration will be $8.00, $4.00 for each non-ham family member. Registration at the door will be $10.00. Activities will include commercial displays, flea market (on Saturday only), QCWA breakfast, MARS, SMIRK, Oklahoma Repeater Society, license exams, and various technical and nontechnical forums. For more information, write Ham Holiday 1985, PO Box 60093, Oklahoma City OK 73146.

GREENSBURG PA
JUL 28

The Foothills Amateur Radio Club, Inc., will sponsor the seventeenth annual Greensburg Hamfest on Sunday, July 28, 1985, at the Nevin Arena, Greensburg PA. Tickets will be $2.00 or 3/$5.00. Indoor ta-

bles will be $5.00 and tailgating will be $2.00. There will be refreshments. Talk-in on 147.78/.18. For further information, advance registration, or tables, write FARC, Inc., PO Box 236, Greensburg PA 15601, or contact WB3KJH.

DENVER CO
JUL 30–AUG 1

The Amateur Radio Motorcycle Club Rocky Mountain Roundup III will be held July 30 through August 1, 1985, somewhere west of Denver CO. The exact location will be named later. Riding radio operators check the ARMC Net on Thursday nights, 0300 UTC, 7237.5 kHz. Send a business-size SASE to Gary McDuffie AG0N, Rt. 1, Box 464, Bayard NE 69334, and ask for net information.

AUSTIN TX
AUG 2-4

The Austin Amateur Radio Club and the Austin Repeater Association, in conjunction with the Texas VHF-FM Society, will sponsor the third annual Austin Summerfest on August 2-4, 1985, at the Austin Marriott Hotel, Austin TX (intersection of I-35 and US 290, on the northeast side of Austin). Registration for all people 18 and older is $5.00 in advance, $7.00 at the door. Swapfest tables will be available on a first-come, first-served basis beginning at 6:00 am on Saturday. Swapfest fees are $1.00 per table, with a two-table limit per registrant. Features will include seminars, a QCWA-sponsored hospitality suite, dealer displays, license exams, and alternate activities. Talk-in on 146.34/.94 and 146.19/.79. For more information, contact Austin Summerfest, PO Box 13473, Austin TX 78711.

POMONA CA
AUG 3

The Tri-County Amateur Radio Association will sponsor a hamfest on Saturday, August 3, 1985, from 8:00 am to 2:00 pm, indoors at the Palomares Park Recreation Hall, 491 E. Arrow Highway, Pomona CA (N. side of Arrow Highway at Orange Grove, between Towne and Garey). Admission is $1.00. A limited number of 2-1/2 × 8 tables will be available for $5.00 per table. Setup is at 7:00 am. Tables must be reserved (call Joe Lyddon WB6UFX at (714)-980-4563). Refreshments and free parking will be available. License exams will be given. For more information or for advanced registration (make checks payable to TCARA), send an SASE to Joe Lyddon WB6UFX, 6879 Sard Street, Alta Loma CA 91701.

TALK SO THEY MAY WALK
AUG 3-4

The Kansas City MO Ararat Shrine Radio Club (WA0NQA) will host its second annual talk-in on August 3-4, 1985, for the benefit of the Crippled Children's Hospitals. We will look for you on the air from 10:00 am to 10:00 pm CST. We will be on the lower 10 kHz of 80, 20, 40, and 15 meters, as well as the 40-meter Novice band. We will offer a two-color certificate with your call and name. Send a large SASE and $1.00 to QSL Manager, Mr. J. V. Foust KA0GBK, 5240 N. Palmer, Kansas City MO 64119.

JACKSONVILLE FL
AUG 3-4

The twelfth annual Greater Jacksonville Hamfest will be held on August 3-4, 1985, from 8:00 am to 5:00 pm on Saturday, and from 9:00 am to 3:00 pm on Sunday, at the Jacksonville Civic Auditorium, on the waterfront in downtown Jacksonville. Admission is $4.00 and children under 16 will be admitted free. Swap tables are $9.00 for one day and $15.00 for both days. Forums, meetings, technical presentations, and an exhibitors' area and indoor swap area will be featured. The facilities are completely air conditioned. For more information, table reservations, or hotel information, send an SASE to the Jacksonville Hamfest Association, PO Box 23134, Jacksonville FL 32241.

GLENN MI
AUG 4

The Black River Amateur Radio Club will sponsor its annual VHF Picnic and Swap and Shop on Sunday, August 4, 1985, from 10:00 am to 3:00 pm, at the West Side Allegan County Park near Glenn MI (10 miles north of South Haven via I-196, Exit 30). Admission will be $2.00. There will be free table and trunk sales. There will be picnic tables, a playground, a Lake Michigan beach, and ample parking. There is no food vendor in the park. For more information, contact Ed Alderman KI8Z, 56500 48th Ave., Lawrence MI 49064; (616)-674-3567.

PITTSBURGH PA
AUG 4

The 48th annual South Hills Brasspounders and Modulators Hamfest will be held on August 4, 1985, from 9:00 am to 4:00 pm, at the South Campus of the Community College of Allegheny County, Pittsburgh PA. Tickets are $3.00 each or two for $5.00. Features include OSCAR, RTTY, and packet forums, plus a flea market. Talk-in on 146.13/.73 and 146.52 simplex. For more information, contact Bill Gardiner, 4756 Child Drive, Pittsburgh PA 15236.

LEVELLAND TX
AUG 4

The Northwest Texas Emergency Net and Levelland Amateur Radio Club will sponsor their annual picnic and tailgate swapfest on Sunday, August 4, 1985, at 7:30 am, at the City Park in Levelland TX. Admission is free. Food and drink will be available. Talk-in on 146.88 (repeater). For further information, contact John Bell W5NGX, 208 Pat Street, Levelland TX 79336.

ANGOLA IN
AUG 4

The Steuben County Radio Amateurs will sponsor the 27th annual Crooked Lake Hamfest and FM Picnic on Sunday, August 4, 1985, at Crooked Lake, Angola IN. Admission is $2.50. There will be an exhibition hall with tables for vendors and a large electronics flea market. Overnight camping will be available (small fee). Picnic-style BBQ chicken will be served. Talk-in on 147.81/.21 and 146.52. For more information, send an SASE to Donn Laird WB9YIT, PO Box 330, Angola IN 46703.

INDIANAPOLIS IN
AUG 4

The WA9SNT Amateur Radio Club will sponsor its annual swapfest on Sunday, August 4, 1985, from 8:00 am to 4:00 pm, at the ITT Technical Institute, 9511 Angola Court (across 465 from Pyramids), Indianapolis IN. Flea-market setup will begin at 6:00 am. Admission is $2.00; students $1.00. Flea-market space will be $1.00 additional. Special features include a large flea market, an electronics equipment auction, and refreshments. Talk-in on 146.94 and 3.910 plus or minus. For additional information, contact Dave Johnston

K9HOO, c/o ITT Technical Institute, 9511 Angola Court, Indianapolis IN 46268; (317)-875-8640.

WORLD POLICE/FIRE GAMES
AUG 4-7

The San Jose State University ARC will operate W6YL to commemorate the 1985 World Police/Fire Games. Operation will be from: 1900 UTC August 4 to 0700 UTC August 5; 1900 UTC August 5 to 0700 UTC August 6; 1900 UTC August 6, to 0700 UTC August 7. There will also be some operation August 7 through 11. Frequencies will be 3.870, 7.240, 14.270, and 147.555 for phone; 7.125 and 14.040 for CW. For a special certificate, send a large SASE to SJSU ARC, c/o Student Programs and Services, Box 2, San Jose State University, San Jose CA 95192.

ROCKFORD IL
AUG 9-10

The Antique Radio Club of Illinois will sponsor Radiofest 85 on August 9-10, 1985, at the Clock Tower Inn, Rockford IL. Events include a two-day swap and sell session, presentations on Atwater Kent, radio restoration, and Reginald A. Fessenden. A display of radio advertising will also be featured. The convention will conclude with a banquet and awards presentation. For more information, write Joe Willis, PO Box 14732, Chicago IL 60614.

MONSTER OF WALGREN LAKE
AUG 10

The Pine Ridge Amateur Radio Club will operate WØFLO from Hay Springs NE, the home of the famous monster of Walgren Lake, on August 10, 1985. The operation will start at 1700 UTC and run until 2400 UTC, 35 kHz up from the bottom of the General-class phone bands, 80-15 meters. For a special commemorative QSL, send a large SASE to NØBUN, H.C. 56, Box 191, Hay Springs NE 69347.

CHARLOTTE VT
AUG 10-11

The Burlington Amateur Radio Club, Inc., will sponsor its annual BARC International Hamfest at the Old Lantern Camp Grounds in Charlotte VT on Saturday and Sunday, August 10-11, 1985. Admission is $4.00 per person for both days, with children under 12 going free. Flea-market space outdoors will cost $2.00. Flea-market space indoors will cost $5.00. For information on overnight camping, contact campgrounds. Activities will include an R/C model airplane show and a CAN-AM tug-of-war. Talk-in on .34/.94, .01/.61, and .52. Please direct queries to Roger WA1OZE, and flea-market space queries to Bob W1DQO, both at Box 312, Burlington VT 05402.

BROOKFIELD ZOO
AUG 10-11

The Chicago Suburban Radio Association will operate special-event station N9BT from the Brookfield Zoo, Brookfield IL, to celebrate the zoo's annual Country Fair Days. Operation will be on August 10th and 11th, from 1500 UTC to 2300 UTC, using the phone frequencies of 146.55, 14.250, and 7.250 MHz. A special QSL card featuring the zoo's Clydesdale draft horse team will be sent to stations that send their QSL card and a #10 SASE to: N9BAT Special Event, PO Box 88, Lyons IL 60534.

CANYON TX
AUG 10-11

The Panhandle Amateur Radio Club will sponsor its 11th annual PARC-Golden Spread Hamfest on Saturday and Sunday, August 10-11, 1985, beginning at 9:00 am on Saturday and 11:00 am on Sunday, at the West Texas State University Activities Center, Canyon TX. Admission at the door is $7.00. Pre-registration is $6.00. There will be commercial distributors, dealers, and a flea market. AMSAT will be represented and upgrading exams will be administered. For further information, contact Rusty Jessup NU5P at (806)-383-0818 evenings, or write PARC Hamfest, Box 1524, Amarillo TX 79105.

MARION IN
AUG 11

The Grand County Amateur Radio Club will sponsor its 6th annual hamfest on Sunday, August 11, 1985, at the 4-H Fairgrounds, Marion IN. This ARRL event will open its doors at 6:00 am, featuring refreshments, free parking, and license exams. Table reservations are $2.00 per 8-foot table. Donation will be $2.00 in advance, $3.00 at the gate. For further information or tickets, send an SASE to Brooks Clark WB9EAP, 2202 South Boots Street, Marion IN 46953.

SONOMA CA
AUG 11

The Valley of the Moon Amateur Radio Club will hold its 5th annual "Ham" breakfast and swapmeet on Sunday, August 11, 1985, at the Sonoma Community Center, 276 East Napa Street, Sonoma CA, from 9:00 am to 4:00 pm. Admission will be $1.00. Swap tables can be set up from 8:00 am, with swap spaces renting for $5.00 each. Plan on bringing your own table, as there are limited tables available. An all you can eat breakfast will be served from 9:00 am to 11:30 am ($5.00). There will be an open auction beginning at 1:00 pm. Displays will include RTTY, computers, high- and low-band stations, an ARRL forum, our club/police department emergency communications van, slide shows, and dealer displays. Talk-in on 147.47 simplex and the local 144.65/145.25 and 146.13/.73 repeaters. The mission museum, historic Sonoma Plaza, and the Sebastiani winery are all within a short two-block walk. For reservation of swap spaces or for further information, call Darrel Jones WD6BOR at (707)-996-4494, or write him at 358 Patten Street, Sonoma CA 95476.

SOUTH CHARLESTON WV
AUG 11

The first annual Charleston Area Hamfest and Computer Show will be held on Sunday, August 11, 1985, from 9:00 am to 4:00 pm, at the South Charleston Community Center (Interstate 64, Exit 54). Admission is $3.00. Flea-market spaces are $5.00. There will be an all-indoor flea market and an indoor pool will be available. Scheduled events include technical and DX forums. Dealer setup is on Saturday, August 10. Talk-in on 146.28/.88 and 146.52 simplex. This is an ARRL-sanctioned hamfest. For further information, send an SASE to Mac McMillian, 2537 Larwood Drive, Charleston WV 25302; (304)-346-6006. Dealers contact Terry Sanner, 218 Forrest Circle, South Charleston WV 25303; (304)-744-0198.

GEORGETOWN KY
AUG 11

The Bluegrass Amateur Radio Society will sponsor the Central Kentucky ARRL Hamfest on Sunday, August 11, 1985, from 8:00 am to 5:00 pm, at the Scott County High School, Longlick Road and US Route 25, Georgetown KY. Tickets are $3.50 in advance and $4.00 at the gate. There is no charge for outside flea-market space. Features will include technical forums, license exams, awards, and exhibits—all in air-conditioned facilities. Talk-in on .76/.16. For more information or tickets, send an SASE to Scott Hackney KI4LE, 629 Craig Lane, Georgetown KY 40324.

WILLOW SPRINGS IL
AUG 11

The Hamfesters Radio Club, Inc., will sponsor their 51st annual hamfest on Sunday, August 11, 1985, at Santa Fe Park, 91st and Wolf Road, Willow Springs IL, southwest of Chicago. There will be an exhibitor pavilion and the famous swappers row. Tickets at the gate will cost $4.00; in advance $3.00. Talk-in on 146.52. For tickets, mail check or money order to Hamfesters, PO Box 42792, Chicago IL 60642.

ST. CLOUD MN
AUG 11

The St. Cloud Amateur Radio Club will hold a hamfest on August 11, 1985, at the Sauk Rapids Municipal Park, on the north edge of Sauk Rapids off MN Highway 15 (Benton Drive). Displays, demonstrations, and trades will be featured. Tickets will cost $3.00. There will be a snack counter. Talk-in on .34/.94 primary, .615/.015 secondary. For further information contact SCARC, Box 141, St. Cloud MN 56302.

DALTON MA
AUG 11

The Northern Berkshire Amateur Radio Club will sponsor a hamfest on Sunday, August 11, 1985, beginning at dawn, at the Dalton American Legion, Route 9, Dalton MA. Admission is $1.00, with XYLs, YLs, and children admitted free. A few tables will be available at no charge on a first-come, first-served basis. Food will be available. Free overnight camping will be permitted on Saturday night (August 10) beginning at 6:00 pm. Talk-in on 146.91.

BREWSTER NY
AUG 17

The Putnam Emergency Amateur League (PEARL) will sponsor its annual Electronics Extravaganza on Saturday, August 17, 1985, from 9:00 am to 4:00 pm, at the J. F. Kennedy Elementary School, Brewster NY. General admission will be $2.00; tables will be $5.00. Walk-in license exams will be given on a first-come, first-served basis. Talk-in on 144.535/145.135. For advance table registration and information, contact R. Dillon N2EFA, RFD #7, Noel Court, Brewster NY 10509.

GREEN BAY WI
AUG 17

The Green Bay Mike and Key Club's Summer Swapfest will be held on Saturday, August 17, 1985, at the Ashwaubenon Community Center, Anderson Drive, located across from Baypark Square Mall (take the Oneida Street Exit off either Hwy. 172 or US Hwy. 41). There will be free admission and parking. Doors open at 8:00 am. 8-foot tables are available by reservation at a charge of $5.00, with a 4-table limit. For further information, contact Bill Johnson N9CNQ, 2177 Orrie Lane, Green Bay WI 54304; (414)-494-8948.

OAKLAND NJ
AUG 17

The Ramapo Mountain ARC (WA2SNA) will hold its 9th annual flea market on August 17, 1985, at the Oakland American Legion Hall, 65 Oak Street, Oakland NJ, just 20 miles from the GW Bridge. Indoor tables will be $6.50; tailgating will be $3.00. Admission is $1.00; non-ham family members are free. Talk-in on 147.49/146.49 and .52. For more information, contact Tom Risseeuw N2AAZ, 63 Page Drive, Oakland NJ 07436; 337-8389 after 6:00 pm.

TACOMA WA
AUG 17-18

The Radio Club of Tacoma will sponsor Tacoma Hamfair-85 on August 17-18, 1985, at Pacific Luthern University, Tacoma WA. Registration is $5.00. Flea-market tables are $15.00 per day or $20.00 for two days (includes one registration). Features include technical seminars, forums, travelogues, a large flea market, license exams, alternate activities, and a dinner ($8.00). Dormitory rooms are $14.00 for a single room and $21.00 for a double room. For more information or to register, write to Grace Teitzel AD7S, PO Box 45079, Tacoma WA 98445, or call Eva Anderson WB7QNS at (206)-564-8347.

HUNTSVILLE AL
AUG 17-18

The Huntsville Hamfest will be held on Saturday and Sunday, August 17 and 18, 1985, at the Von Braun Civic Center in Huntsville AL. There will be no admission charge. Flea-market tables will be available for $5.00/day and should be reserved prior to the hamfest. There will be exhibits, forums, and non-ham activities. Walk-in FCC exams will be given at the Huntsville High School cafeteria beginning at 9:00 am, Saturday, August 17. Tours of the Alabama Space and Rocket Center will be available for the family. A limited number of camping sites with hookups are available at the VBCC on a first-come, first-served basis. Talk-in on .34/.94. For more information, write Huntsville Hamfest, 2804 S. Memorial Parkway, Huntsville AL 35801.

BLOSSBURG PA
AUG 18

The Tioga County Amateur Radio Club will hold its 9th annual hamfest on Sunday, August 18, 1985, from 9:00 am to 5:00 pm, at Island Park, just off Route 15, Blossburg PA. Admission is $3.00 per person; XYLs and children are free. Exams will be given on a walk-in basis. For exam information, write TCARC, PO Box 56, Mansfield PA 16933. There will also be a flea market, dealers, snack bar, and a park and pool for children. Talk-in on 146.19/.79 and 146.52. For further information, contact Durwood Learn WB3DKZ, 11 Bryden St., Wellsboro PA 16901; (717)-724-5613.

LAFAYETTE IN
AUG 18

The Tippecanoe Amateur Radio Association will hold its 14th annual hamfest on Sunday, August 18, 1985, beginning at 7:00 am, at the Tippecanoe County Fairgrounds, Teal Road and 18th Street, Lafayette IN. Admission is $3.00. Features will include a flea market, dealers, and refreshments. Talk-in on .13/.73 or .52. For tickets or for more information, write the Lafayette Hamfest, Route 1, Box 63, West Point IN 47992.

WARREN OH
AUG 18

The annual WARA hamfest will be held on Sunday, August 18, 1985, beginning at 8:00 am, at Kent State University (Trumball Campus). The flea market opens at 6:00 am. Tickets will be $2.50 per adult in advance and $3.00 per adult at the gate. Children under 12 years of age go free. There will be a large XYL room, talks, crafts, programs, and refreshments. For information or advance tickets until August 1, 1985, please QSL WARA, c/o KD8KJ, PO Box 809, Warren OH 44484.

VJ DAY 40TH
AUG 18-19

The DuPage Amateur Radio Club will be operating special-event station W9DUP in honor of the 40th anniversary of VJ Day. Operating hours will be from 1300 UTC on August 18, 1985, until 0200 UTC on August 19, 1985, from the deck of the submarine, *USS Silversides*, which is docked as a War Museum alongside Navy Pier in Chicago. Frequencies will be 14.240 and 7.240 MHz. For a special submarine QSL card, send an SASE to W9DUP, PO Box 71, Clarendon Hills IL 60514.

WASHINGTON DC
AUG 22-24

The Personal Computer and Standard Computer Interfacing for Scientific Instrument Automation Workshop, sponsored by Virginia Tech, will be held August 22-24, 1985, in Washington DC. The cost is $450 for the three-day session. This is a hands-on workshop, with each participant wiring and testing interfaces. The course will be directed by Mr. David E. Larsen and Dr. Paul E. Field. For more information, contact Dr. Linda Leffel, C.E.C., Virginia Tech, Blacksburg VA 24081; (703)-961-4848.

ITHACA NY
AUG 24

The Tompkins County Amateur Radio Club will sponsor the Finger Lakes Hamfest on August 24, 1985, 12 miles north of Ithaca NY on Route 96. There will be a flea market, dealers, programs, and free overnight camping. Talk-in on .37/.97. For more information, contact David Flinn W2CFP, 866 Ridge Road, Lansing NY 14882; (607)-533-4297.

MARYSVILLE OH
AUG 25

The Union County ARC will sponsor its 9th annual hamfest on August 25, 1985, from 8:00 am to 4:00 pm, rain or shine, at the fairgrounds in Marysville OH. Admission is $3.00 at the gate, $2.00 in advance. Children and XYLs are admitted free. Flea-market space is $1.00 per 10-foot space. There will be overnight camping permitted on Saturday night. Food will be available. For further information, contact Gene Kirby W8BJN, 13813 US 38, Marysville OH 43040; (513)-644-0468.

ST. CHARLES MO
AUG 25

The St. Charles Amateur Radio Club will sponsor a hamfest on Sunday, August 25, 1985, at the St. Charles City Hall complex, 200 North 2nd Street, St. Charles MO, rain or shine (it's under cover). Tickets will cost $1.00 in advance, $1.50 at the door. Parking will cost $1.00. There will be a giant flea market, commercial vendors, programs for XYLs, FCC exams, and food. Talk-in on 146.07/.67 and 146.52. Tickets are available from Denise WDØCZE, 121 Barkwood Trail, St. Charles MO 83303.

SAGINAW MI
AUG 25

The Five County Swap-N-Shop Committee of Michigan, made up of members of amateur-radio clubs from Bay, Saginaw, Genessee, Lapeer, and Shiawassee Counties, will sponsor their ninth annual Swap-N-Shop on Sunday, August 25, 1965, at the Saginaw Civic Center, Saginaw MI. Advance tickets will cost $2.00; tickets at the door will cost $3:00. Table rental is $7.00 per table (tables are 3 feet by 8 feet). There will also be a *covered trunk* sales area at $3.00/car. Advance ticket orders and table reservations may be sent to Five County Swap-N-Shop, PO Box 2204, Saginaw MI 48605; (517)-777-8683.

BLUEFIELD WV
AUG 25

The East River Amateur Radio Club, Inc., will sponsor the Bluefield Hamfest on Sunday, August 25, 1985, from 9:00 am to 3:00 pm. Activities will take place at the Brushfork Armory-Civic Center, one mile north of Bluefield, West Virginia, on US 52. Admission will be $4.00 per person with children under 12 admitted free. There will be a large indoor flea market, amateur-radio dealers, computer dealers, satellite TV, and various specialty dealers. License exams will be given. Food and paved parking will be available. Talk-in on 144.89/145.49 and 146.52 simplex. For more information, write Jim Perdue KC8NG, Rt. 5, Box 457, Bluefield WV 24701.

HERSHEYPARK PA
AUG 25

The Central Pennsylvania Repeater Association, Inc., will sponsor its 12th annual Hamfest/Computerfest on August 25, 1985, adjacent to Hersheypark, Chocolate Town, USA. Registration will be $3.00. Children 12 and under are free. There will be special reduced admission to Hersheypark available for registrants and their families. There will be a large indoor dealer and flea-market area and a large outdoor tailgate area. Food and refreshments will be available. Talk-in on 145.47 repeater or 146.52 simplex (WA3KXG). For further information, contact Paul W. McDonnell N3BKI, (717)-697-1880 from 12:00 noon to 8:00 pm.

OK CORRAL
TOMBSTONE AZ
AUG 31-SEP 2

Special-event station W7GV will operate from the 4th annual Rendezvous of the Gunfighters, on Labor Day weekend, from the OK Corral, Tombstone AZ. The OK Corral was the site of the shoot-out between the Earp and Clanton factions in 1881. W7GV is the oldest active amateur-radio call in the state. Operations will begin at 1500 UTC, August 31, and will run through 2200 UTC, September 2. Frequencies will be: SSB—28680, 21380, 14280, 7280, and 3730; CW—21130, 7130, and 3730. A certificate will be awarded to all who work W7GV, as well as SWLs. Please send a large 8-1/2 × 11 SASE (40 cents postage) to W7GV, PO Box 36032, Tucson AZ 85741.

BLOOMINGTON IN
SEP 1

The 8th annual Bloomington Hamfest will be held on Sunday, September 1, 1985, from 8:00 am until 2:00 pm, at the 147.18/.78 repeater site, 2335 Vernal Pike off SR 37 bypass. Admission is $2.00. Food will be available. There will be no charge for selling; bring your own table. For FCC VE exams, contact K9PS for details and exam times. For further information, send an SASE to Bob Myers K9KTH, 306 S. Fairview St., Bloomington IN 47401; (812)-332-1105.

WINDSOR ME
SEP 7

The Augusta Emergency Amateur Radio Unit will sponsor the 1985 ARRL-sanctioned Windsor Hamfest on Saturday, September 7, 1985, at the Windsor ME Fairgrounds. Gate donation is $1.00, and camping is $3.00 per night or $5.00 for two nights. There will be a flea market, programs, speakers, commercial distributors, light meals, and the traditional Saturday bean and casserole supper. Talk-in on 146.22/.82. For further information, contact Ron Dishman N1CMZ, 37 Marlboro Avenue, Augusta ME 04330; (207)-623-8351.

UNIONTOWN PA
SEP 7

The Uniontown Amateur Radio Club will hold its 36th annual Gabfest on Saturday, September 7, 1985, on the club grounds located on the Old Pittsburgh Road, just off Rt. 51 and the 119 bypass, in Uniontown PA. Registration is $3.00 each or 2 for $5.00. There will be free parking, free coffee, and free swap and shop with registration. There will be plenty of good food at the refreshment stand. Talk-in on 147.645/.045 and 144.57/.17. For further information, contact UARC Gabfest Committee, c/o John T. Cermak WB3DOD, PO Box 433, *Republic PA* 15475; (412)-246-2870.

HANCOCK COUNTY OH
SEP 8

The Findlay Radio Club will sponsor the 43rd annual Findlay Hamfest on Sunday, September 8, 1985, from 6:30 am to 5:00 pm, at the Hancock County (Ohio) Fairgrounds. Tickets are $3.00 in advance and $4.00 at the door. Tables are $6.00, and outdoor flea-market spaces are $3.00. Talk-in on 147.75/.15. For more information, contact the Findlay Radio Club, PO Box 587, Findlay OH 45839.

WILLOW SPRINGS IL
SEP 8

The Bolingbrook Amateur Radio Society will hold BARS Hamfest 85 on Sunday, September 8, 1985, at Santa Fe Park, 91st Street and Wolf Road, Willow Springs IL. Admission is $2.00 in advance and $3.00 at the gate. Overnight parking will be available. Food will be available. Talk-in on 147.33/.93 and 146.52. For more information, contact Ed Weinstein WD9AYR, 7511 Walnut Avenue, Woodridge IL 60517; (312)-985-0527.

GREAT SALT PLAINS LAKE
SEP 8

The third annual Great Salt Plains Ham Social (serving the Oklahoma-Kansas state line area) will be held on September 8, 1985, at the community building on the south side of Great Salt Plains Lake. Free swap tables and refreshments will be available. Talk-in on 147.90/.30. For more information, contact Steven Walz WA5UTO, PO Box 222, Cherokee OK 73728; (405)-596-3487.

MONETT MO
SEP 8

The Ozarks Amateur Radio Society will sponsor the 4th annual Ozark Amateur Radio Club Congress and Swapfest at City Park, junction of US Highway 60 and Missouri State Highway 37, Monett MO, on Sunday, September 8, 1985. There will be a swapfest at 11:00 am and a buffet dinner at 1:00 pm. No tickets are necessary. All amateurs and families are welcome. Talk-in on 146.37/.97 MHz, 146.52 MHz, and 7.250 MHz. For more information, write or call the Ozarks Amateur Radio Society, Box 327, Aurora MO 65605; (417)-678-5330.

VIRGINIA BEACH VA
SEP 21-22

The Tidewater Radio Conventions, Inc., is sponsoring the 1985 ARRL Virginia State Convention and 10th annual Amateur Radio-Computer Fair on Saturday and Sunday, September 21 and 22, 1985, from 9:00 am to 5:00 pm, at the Virginia Beach, Virginia, Pavilion. Advance admission tickets for both days are $5.00. Tickets at the door will be $6.00. Flea-market tables will be $5.00 for one day, $8.00 for both days. Featured activities include dealers, special displays, forums, computer equipment, ARRL license exams, free XYL bingo, and movies for the kids. For information and tickets, write or call Jim Harrison N4NV, 1234 Little Bay Avenue, Norfolk VA 23503; (804)-587-1695.

PEORIA IL
SEP 21-22

The Peoria Area Amateur Radio Club will sponsor Superfest 85 at the Exposition Gardens, W. Northmoor Road, Peoria IL, on Saturday and Sunday, September 21-22, 1985. Gates open at 6:00 am; the commercial building will open at 9:00 am. Admission will be $3.00 in advance and $4.00 at the gate. Children under 12 are free. Activities will include amateur-radio and computer displays, a huge flea market, FCC exams for all classes on Saturday *only*, and a *free bus* to Northwoods Mall on Sunday. There will be full camping facilities on the grounds. Talk-in on 146.16/.76 (W9UVI). Information or reservations are available for an SASE to Superfest 85, PO Box 3461, Peoria IL 61614.

UPSTATE NY
LICENSE CLASSES

Amateur-radio training programs for all license classes are scheduled to start in the fall in four New York areas: Potsdam-Canton, Fort Covington-Hogansburg, Malone, and Saranac Lake-Lake Placid. For a complete schedule, contact the Program Coordinator, Al Lapier W1CSF, Duane Road, Mountain View NY 12963; (518)-483-0046.

WIA 75TH ANNIVERSARY

The Wireless Institute of Australia, the world's first radio society, will celebrate its 75th anniversary during 1985. The WIA 75 Award will be available during the period from March 1, 1985, to December 31, 1985. To qualify, amateurs (and SWLs) need to contact (log) 75 members of the WIA. A contact will be valid only if the WIA member's individual membership number is logged. No more than 30 WIA members may be logged in any one callsign area. Send a log extract of the 75 members contacted and $2.00 (Australian) to WIA 75 Award Manager, Wireless Institute of Australia, 412 Brunswick Street, Fitzroy 3065, Victoria, Australia.

HAM HELP

Does anyone have coils or information for an Eico grid-dip oscillator?

Jon Danford
2115 Joplin
Joplin MO 64801

I need a service manual for the Azden PCS-3000 transceiver, especially the alignment instructions. *I will be happy* to pay for copies and postage.

Ruben Sanchez XE1RSE
Esteros 18 Las Aguilas
01710 Mexico, D.F.
Mexico

BE MY GUEST

Guest Editorial by Joan Tanya Chopin WA6BXT

GIVE A HOOT

As a rag-chewer, I am continually appalled by the habits of contesters. Day after day I use the 40- and 80-meter bands and take care of them as if they were my own. Then suddenly a contest weekend arrives and the bands are wall to wall with contesters who use the bands for contests only and often treat them unkindly.

I can understand the frenzied pace during a contest that would prevent the avid users from keeping things tidy, but what about later? The day following a contest is the most depressing.

The frequencies are littered with worn-down pencils, crumpled scratch paper, used chewing gum stuck under the Novice band, cigarette butts, a dupe sheet here and there, empty coffee cups, and occasionally a random contester in a comatose state sprawled across 10 or 20 kHz. It is a *disgrace!* Some even have a twitch remaining in their sending hand. Even the most spirited CQs won't awaken them. This is particularly evident after a two-day contest. The longer the contest, the more mess is left. I once found a stale donut just inside the Extra portion of the 80-meter band a week after a Sweepstakes CW weekend.

Why must they be so sloppy? And if they must, why can't they clean up after themselves? Perhaps one reason is that many of them aren't using their own calls during contests so they feel somewhat anonymous. "Who will know if I just leave this soft drink can here? No one can identify me, anyway."

Often they do their operating in the wee hours of the night and steal away into the darkness, never to be seen again until the next contest. Some do operate for the entire contest period, but as soon as the rubber clock strikes 0000 UTC, they hit the road with nary a glance at the messy frequencies they are leaving behind.

In all fairness I suspect that many of the contesters don't even realize the error of their ways. They are operating with such fervor that they are thinking of nothing but Qs and multipliers at the time. I suppose it is incumbent upon us regular users of the bands to educate these folks.

Perhaps we should post signs before the contest begins reminding them of their obligations to clean up their mess. Maybe it should be written into the rules: 42 hours of operating time, 6 hours to clean up the frequencies. It might be effective to build the reminders into the contest exchange: "NR 562, SCV, don't litter."

I must admit that I have not seen much vandalism of the bands. The disasters are always reparable, except for one "KB" apparently etched with a soldering gun which I discovered on the 40-meter Novice band just after the Novice Roundup a few years ago. This faded away in time and was fortunately an isolated incident.

I guess the greatest hope of finding a solution to this problem is to turn to those contesters who also operate during non-contest times. Though I cannot say for sure, I suspect they tend to have fewer offenders among them. These are the hams who are active in traffic, DX, or rag-chewing between contests and they, too, are faced with the aftermath on a Sunday night following a contest.

Perhaps we could recruit contesters who are public-service-oriented hams to take turns patrolling the bands during contests and report violators to a net control who could then issue reminders to the offenders before the contest was over. After a few warnings, offenders could be required to be on a clean-up committee. This would serve to make the contesters more aware of their responsibilities as well as create a clean-up crew to tend to the tidying up.

However it is handled, it should be the responsibility of the contesters themselves to leave the bands as they found them, rather than expect us overworked rag-chewers to clean up after them. Nobody is begrudging them their fun, but let's add some class to the act! ■

Joan Tanya Chopin WA6BXT is a freelance writer from San Carlos, California. A teacher of hearing-impaired children, she is also an avid CW rag-chewer and occasional DXer.

ABOVE AND BEYOND

Peter H. Putman KT2B
84 Burnham Road
Morris Plains NJ 07950

Welcome to the exciting, diversified, and often unpredictable world of VHF/UHF hamming! For many of you, this column may be your introduction to the world above 50 MHz. For others, it may serve to help you enjoy your casual use of these bands. Seasoned, experienced operators will be helped to use these frequencies to their full potential.

Enjoy building antennas? How about DX arrays (with over 16 dB of gain) that will fit in your living room! Is chasing DX your thing? OSCAR makes it easy—anywhere in the world. Are you into computers? Packet radio on 220 MHz is up and coming fast! Or maybe amateur television (ATV) is your bag. See you on 439.25 MHz!

The frequencies above 50 MHz offer unlimited possibilities. Virtually every licensed ham now has privileges to operate these bands (except Novices, and they may change yet), and that includes *all* modes—CW, SSB, FM, AM, RTTY, ATV, pulse, packet, and satellite. You name 'em, they're here and *thriving*.

Before I go further, a few words about myself are probably in order. I've been licensed since 1970 and hold an Extra-class license. My first love was, and still is, building. I particularly enjoy constructing antennas, amplifiers, and knickknacks such as the VHF/UHF wattmeter that appeared in September, 1984, in *73*. Currently, I'm active on 144 MHz, 220 MHz, 432 MHz, and 1296 MHz. Equipment for 50 MHz will be on the air by the time you read this.

Enough about me! I want to hear from *you*. About your station, operating habits, DX chased, favorite modes, and any technical or operating hints that could be of use to all readers of this column. Don't be bashful! Send photos if you've got them. Black and white are best, preferably 5 × 7 or 8 × 10. If you've got a really great color shot, however, send it anyway as I have the facilities to convert color shots to black and white here. This column is meant for *you* to enjoy and the best columns have input from all readers.

I hope to keep you informed about new products of interest to the VHF/UHF enthusiast, and there are certainly enough of them on the market. If you've got something new—antennas, transceivers, amplifiers, converters, preamps—write me and tell me about it. Word of mouth sells more equipment than you can imagine (and can also turn people off to a brand if it just can't make the grade). I'll try to be as objective in these reviews as I can. If something isn't appropriate or worth the money, I'll let you know. However, if there's a fantastic new transverter on the market, you bet I'll tell you about it.

As far as technical articles go, I'll try to avoid getting too technical. *73* readers prefer straightforward how-to-build-it articles. Great! I never spend too much time on the calculator if I can help it. Topics to be covered will include feedlines, preamplifier gain vs. noise figure, multimode radios vs. transverters, solid state vs. tubes, and, most importantly, understanding the types of propagation that make these bands so unique and exciting to use.

Being an active member of the Society of Contest Operators and Radio Experimenters (SCOPE), I love VHF/UHF contests. Here's a perfect way to test out that new 432-MHz preamp or 50-MHz beam. And you don't have to spend a fortune to get on and have some fun. A reasonably equipped station for 144 MHz need not cost more than about $500-$600 brand new (multimode transceiver, beam, and 100-Watt amplifier). Older equipment can be pressed into service at an additional savings if need be. And you can always build your own antennas if you feel ambitious.

Perhaps the best way to kick off this month's column is to quickly discuss the nature of the commonly used VHF/UHF bands in this country—50 MHz (6 meters), 144 MHz (2 meters), 220 MHz (1.25 meters), 432 MHz (70 centimeters), and 1296 MHz (23 centimeters). These bands constitute the bulk of amateur VHF/UHF activity today. There is activity above 1296 MHz, but the lack of equipment, cost of construction, and critical tolerances inherent in operating here put these bands out of the reach of most amateurs in the US and Canada. (In Europe, it's somewhat a different story, with more active stations and a bit more equipment available.)

The first of our VHF allocations starts at 50 MHz (6 meters). Modes used here include SSB (a lot), CW (very little), and FM. Propagation normally is about 50-100 miles with reasonable power and antennas. But the big attraction is the unique effects of four types of propagation: aurora, sporadic E (referred to from here on as E_s), scatter, and F_2 propagation. Any one of these modes can result in some pretty impressive DX! For example, when an *aurora borealis* is present, signals can reflect off the auroral curtain and be received from 500 to 1000 miles away. CW is the preferred mode here because the received signals are quite distorted!

Things really start hopping on 6 meters about late April and early May. This is the beginning of the E_s season, when thunderstorms and severe weather activity cause the E layer of the ionosphere to become ionized. Stations running barefoot multimode radios (25 Watts or so) are suddenly surprised to hear Florida coming through in New Jersey, or California in Illinois. E_s makes it possible by acting like a giant mirror to reflect these signals back to Earth many thousands of miles away!

The last two modes, scatter and F_2, are not as commonly used. The former is quite tricky and requires patience, as you are actually listening for signals reflected from an ionized meteor trail. These "bursts" can be CW or SSB and may last only seconds. Scatter takes a lot of hard work but the results can be worth it—such as England to South America using 100 Watts! F_2 layer propagation is similar to that found on the HF bands, but with the sunspot cycle now in its minimum, F_2 propagation is nonexistent. In the peak season of 1979-1980, New Zealand was worked by WA2VUN in New Jersey with just 80 Watts and a single beam. And you thought 6 meters was only good for TVI, eh?

Next, we turn our attention to 144 MHz (2 meters). This is the most popular and most congested amateur allocation in the entire world! The most popular mode here is, of course, FM. But many users of FM are unaware of the possibilities using CW, SSB, and even OSCAR. Normal propagation using modest equipment is about 30 to 100 miles, depending on your location. But when 2-meter propagation occurs, it's usually in one of three ways: aurora, E_s, or tropospheric propagation. The first two work just as they do on 6 meters, with aurora being a bit more intense on 2 meters. The distance worked can be from 600-1000 miles with moderate power and good antennas. E_s on 2 meters is not as common as on 6 meters but provides equally spectacular results. In 1982, a rare form of E_s called double-hop resulted in QSOs between New Jersey and Wyoming using only ten Watts! *Wow!* More often than not, you'll be able to hook into the southern states from the Northeast and Midwest quite often using this mode. Again, E_s is influenced by severe storm activity and thunderstorm action, usually many miles away.

An excellent study of the effects of severe weather and solar activity on 144-MHz E_s propagation has been published by Sid Leiberman WA2FXB and provides a thorough treatment of the topic. I'd be glad to refer inquiries to Sid if you're interested.

The third form of propagation on two meters usually starts showing up in late July, about the time the E_s season is winding down. How often have you keyed up your favorite repeater on an early August morning and heard two, three, sometimes four squelch tails? That's tropospheric propagation! The troposphere is the part of the earth's atmosphere that generates all our weather. What often happens is that a temperature inversion occurs: As elevation increases in the atmosphere, the temperature drops and then suddenly rises again. When this occurs, these boundaries between cold and warm air will reflect two-meter signals—sometimes for a thousand miles!

Another form of tropospheric propagation is called ducting, and it doesn't occur as often on 2 meters as it does on higher frequencies. We'll touch on this in a moment, but let's take a look at 220 MHz (1.25 meters). The poor 220-MHz band has been

the constant source of discussion and controversy for many years. Commercial interests covet it, and there have been many proposals before the FCC to put a code-free license on 220 MHz. Novices may yet see their long-lost VHF privileges restored some day on this band.

Typical propagation on 220 MHz is usually about 40–80 miles with modest power. It behaves very much like 2 meters, but being higher than Channel 13, the band is subject to less interference than two meters. The primary mode used here is FM and there are more repeaters going on every day. Also, you'll find many SSB and CW stations here. Propagation is limited to mostly tropospheric varieties, but E_s can occur with spectacular results. Channel 13 can be watched for a tip-off of E_s when it occurs.

Aurora will also occur but is rare. Many enthusiasts have tried and successfully worked scatter here as well as 2 meters. EME (Earth-Moon-Earth, or moonbounce) is popular on this band due to the relative inactivity. Note that 220 MHz is exclusively a North American allocation on a shared basis for amateurs. No one else in the world has it, which explains why the big manufacturers haven't come out with multimodes for this band. There just isn't enough of market—*yet*. Don't let that stop you, however, as 220 MHz needs more activity to keep it as an amateur allocation!

Finally, 432 and 1296 MHz. These are truly UHF bands and can be justifiably called "microwaves." Their wavelengths of 70 cm and 23 cm are indeed small, allowing the use of high-gain antennas that take up very little room and are lightweight. Typical DX might be 40-100 miles (not unlike 2 meters) using 100 Watts and a 22-element beam. Scatter is nonexistent here. Some stations have worked aurora on 432 MHz, but it is very difficult! The avid 432 DXer relies mostly on tropospheric propagation, such as that produced by inversions and ducting. Ducting occurs when a layer of cold air is trapped between two layers of warmer air, forming sort of a waveguide effect. Once inside this meteorological transmission line, your 432-MHz signal can skip along for many hundreds of miles before coming back to Earth—often in surprising places.

Modes used on 432 include SSB, CW, FM in the 440-450-MHz portion, and amateur television (ATV) around 439.25. There's plenty of room here since the band is 20 MHz wide! There's also lots of equipment available, as 432 is fast becoming a popular band worldwide.

On 1296 MHz, the same propagation rules apply and the antennas are even smaller for a given gain figure. How about an 88-element antenna with 20+ dB gain weighing only 3 pounds? Feedlines become more critical and beamwidths are narrow. But you can work about 25-50 miles with a good antenna and 5 to 10 Watts. More equipment is coming on the market every day for this band and the prices are dropping. 1296 MHz is truly a band for the adventurous!

That concludes our band summary! Next month, we'll tackle antennas and feedlines for these bands and delve into such topics as why you just can't use RG-58/U on 432 MHz with 2 Watts and expect to work anybody. Send in your contributions, photos, stories, tech tips, or whatever. I'll try to get them in. I'd like our overseas readers to send me information on their doings, especially our friends in Europe, which is a real hotbed of VHF/UHF activity.

DX

Chod Harris VP2ML
Box 4881
Santa Rosa CA 95402

IS DOG X-RAY GOING TO THE DOGS, OR TO THE ARMADILLOS?

DX is like the fireman's dalmatian—neither is quite the same without spots. In the case of DX, the spots we are talking about are 93 million miles away, on the surface of the sun. Or at least, that's where they would be, if there were any. And without the streams of charged particles from sunspots to ionize our upper atmosphere, long-distance communications goes to the dogs.

Just a few short years ago anyone with a converted 5-Watt CB rig and a handful of aluminum could work the world on ten meters. Working all continents was a trivial task. (My best time for WAC with individual contacts was 13 minutes, although on more than one occasion, stations from all six continents on the same frequency could all hear each other—a rarity today.)

The high static and noise levels of the summer season compound the problem of lack of sunspots by wrecking low-band contacts. The few band openings are short, signals weak, and pileups fierce, as more DXers chase fewer DX stations. The poor radio propagation (and prospects for worse) discourage DXpeditions. And conditions are unlikely to improve soon, except for seasonally better propagation in the fall and spring. The last sunspot cycle bottomed out in 1975, which suggests the current cycle will hit minimum sunspots next year. Even after sunspot numbers begin to increase in the late '80s, radio propagation will take years to recover to former levels, if it does at all. The specter of the Maunder Minimum always arises at sunspot minimums. (The Maunder Minimum was a period of almost 50 years when the sunspot number *never* exceeded the abysmal totals that we are experiencing today. 50 years of lousy DX? The mere thought makes my elements droop.) All in all, the future looks bleak for DXers.

So what does the die-hard DXer do? Unplug the key, hang Christmas lights off the tower, and start watching the tube instead of interfering with it? Ugh. What a terrible prospect! Fortunately there is hope for DXers everywhere. There is life without sunspots, even if DXCC takes years instead of months. Here are three suggestions to revitalize your DX enthusiasm: make better use of present resources, set

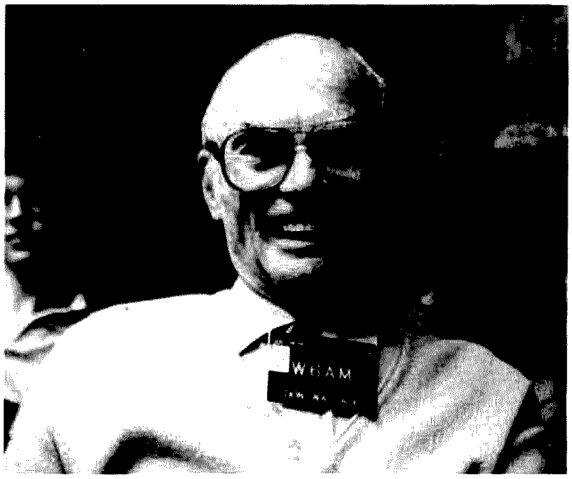
DON WALLACE W6AM

The DX community lost one of its pillars in late May, when Don Wallace W6AM passed away after a lifetime of DXing. Don's DX accomplishments are legend and include DXCC award No. 1, membership in *CQ*'s DX Hall of Fame, and top of the Honor Roll for most of the past 20 years. He was one of the first DXers to earn Worked All Continents, back when such was a considerable feat.

For more than 40 years Don operated from one of the best-known DX locations in the world: the DX ranch at Rancho Palos Verdes, 20 miles from downtown Los Angeles, California. Don's amateur station (he actually lived 10 miles away in Long Beach) was perched atop a 1200'-high hill on a peninsula which sticks out into the Pacific Ocean. The site is one of those near-perfect radio locations about which DXers dream. With a clear shot in every direction (over water in most cases) and with excellent apparent height, the DX ranch effectively pumped out rf on a wide range of frequencies from the amateur bands up through UHF (the latter from a host of business repeaters and equipment on the site). While managing a communications business (including those repeaters), Don assembled a world-class amateur station without a single rotatable beam!

Don's shack featured the best available amateur gear, including many pieces of Collins equipment, sensibly arranged for easy operation. But visitors searched in vain for the rumored high-powered amplifiers that some thought were the keys to the impressive signal of W6AM. Don didn't need illegal power; his nonrotatable-antenna farm was his pileup buster. That antenna farm consisted of 9 separate rhombic antennas, capable of firing DX in eighteen different directions. Where other amateurs turned their rotatable beams, Don flicked switches to select the appropriate rhombic. The dozens of rhombic-supporting telephone poles (some extending to 140') which dotted the 24-acre site gave the impression of a surrealistic forest, with wires instead of leaves on the trees. Appearances aside, nobody laughed when Don transmitted.

For Don Wallace was more than a super station. He was a friendly, helpful amateur who was consistently active in DX through more than four sunspot cycles. There has seldom been a country in the history of DX which Don didn't work. He was always among the first through the pileup, from the very first Clipperton DXpedition (see last month's report) to the latest trip. Don always had a good word for hard-working DXpeditioners. And he was also very active in station maintenance. Unlike some well-to-do amateurs who hire station managers to keep up the antenna farm, Don trotted up and down his forest of telephone poles himself, replacing broken wires, tuning, adjusting. How many amateurs do you know who frequently climbed higher than their ages? While Don did reluctantly give up climbing to the 140' levels when he was in his 70s, he didn't hesitate to haul his 70+-year-old frame up to the 70+-foot level to repair the intermediate-level antennas.



Top DXer and rhombic antenna enthusiast Don Wallace W6AM passed away in late May. He will be missed.

Even away from the DX ranch, Don was a force on the amateur bands. His mobile kilowatt rig chopped through pileups while Don drove and operated throughout southern California and further afield. His mobile QSL card has a space for "mph" during the QSO. And much of his mobile operation was CW! This writer finds it hard to imagine anyone surviving 40 years of driving around LA, much less running a kilowatt of CW all the time!

Don also shared his station with area hams. Many contesters have enjoyed the fine propagation and unique antenna switching at W6AM. And each June, Don held an Open House at the DX ranch, inviting amateurs from all over to view his shack and rhombics. He often visited DXers' homes during his travels, bringing a touch of DX cheer wherever he went. And Don supported many DX foundations, including serving on the board of some.

Don Wallace W6AM was truly a major force in the DX world. His passing leaves a sincere sense of loss among DXers everywhere. He will be missed by DX and DXer alike.

new DX goals and challenges, and/or redefine DX.

The Conservative Approach

The traditional DXer can make good use of sunspotless summer days by fine-tuning his DX hardware and software. When the bands are hot, the DXer can get away with all kinds of imperfect equipment and operating techniques. But as the sunspots wane, only the best-equipped stations and most careful operators will enjoy consistent DX success. This doesn't mean you have to get a second mortgage on your home to stick up stacked monobanders, but rather that you should make the best possible use of your available DX resources.

Start by tuning up your station, from top to bottom. Realign and tighten antenna elements. Replace that leaking trap which keeps you off 20 meters when it rains. Pay particular attention to your feedline. Even a small water leak under the outer jacket of your coax can seriously corrode the braid. The connection between the feed and the antenna itself is a frequent source of trouble. Consider lobbing off a few feet of feedline and replacing this critical connection. Or take the money you're saving by not sending out many QSL cards and buy some new feedline, eliminating those seven barrel connections between antenna and shack. The feedline between transmitter and antenna may be the most neglected part of your station equipment, and a poorly designed and maintained feedline can rob as much as half of your signal, both transmitting and receiving! Typical problems with coaxial-cable feedlines include too tight taping to tower legs (the tape can crush the cable), long, unsupported runs above the ground (while the coax is out of the way of the lawnmower, the long run stretches and weakens the cable), and water or other contamination inside the cable itself. Watch for tight bends; they create large impedance bumps. Cable manufacturers suggest limiting turns to at least 20 times the coax diameter, or about a 10" circle for RG-8.

Next review the signal patch within your shack. How many connections, meters, tuners, etc., lie between rig and antenna? Every one robs signal strength on both receive and transmit. When 10 meters is wide open, 2 Watts into a bedspring will work the world, but these days every 0.1 dB counts. Finally, check out your rig itself. When was the last time you peaked the receiving circuits? How about the drive circuits? If you're still using those glass bottles with the glowing wires inside, have you neutralized the finals lately? A few hours cleaning and adjusting your DX hardware will pay handsome dividends during the dog days of DX.

Even the best-equipped and most finely tuned station is of little value without the expertise to operate it effectively. The random operating and sloppy techniques that in recent years filled the shack walls with DX QSLs yield nothing but frustration in today's intense pileups. How does the DXer tune up his DXing software? He bones up on propagation, pays particular attention to who is on when, and hones his DX operating skills.

Mastering Propagation Mysteries

Sunspot minimums are excellent opportunities to learn more about the ever-fascinating field of propagation. With signals weak and interference at a minimum, the down-in-the-mud stations are workable by those who know where and when to look. Use the Northern California DX Foundation 20-meter beacon system on 14100 to compare propagation at your station with the propagation charts published each month in *QST*. Check out grayline, transequatorial, and other propagation modes by changing the time you operate or by aiming your beam in another direction. Watch 20 meters for the rapidly shortening skip that heralds a 15-meter opening. And don't hesitate to send a CQ on a seemingly empty band.

10 meters, for example, offers a remarkable amount of DXing, even at the dead bottom of the sunspot cycle. The trouble with 10 meters is that everyone listens and nobody transmits. The band always sounds dead. Try a CQ and see what turns up. Once in a while, you will be very pleasantly surprised.

At the bottom of the last sunspot cycle, I was operating from West Africa on 15 meters when I noticed that the skip distance was getting shorter. (In other words, the signal strength of stations closer to me was increasing, a good indication that the next higher band might open.) I switched to 10 meters and tuned hopefully across the band. Nothing. Not even a peep. Facing the prospect of retuning the 17 knobs and switches necessary to get back down to 15 meters, I decided to try a long CQ on the off chance that someone, somewhere, was listening. As I eased my foot off the foot switch after a one-minute CQ, the receiver exploded with a roar. At first I thought I had 40-over-9 power-line noise, but the roar gradually began to resolve into individual callsigns. 10 meters was wide open to Europe and North and South America, but everyone was listening. Until my CQ, the band might as well have been closed. So don't just tune quickly across the band and give up; try a CQ. And listen for the host of 10-meter beacons in the 28200–28300 range.

Another technique to improve your DX payout without sunspots is to pay more attention to who is on when. First you need to know exactly which countries you have confirmed and which you still need. Careful, up-to-date record-keeping is a must (and we'll talk more about this in a future column).

Then turn to the weekly and biweekly DX bulletins, local DX repeater or DX club meetings, or other source of current DX information. Among the other tidbits offered in these sources are vital clues to the operating habits of DX stations in countries you need. Look for regular activity from these countries. Most DX operators get on the air at about the same time each day, and usually at about the same frequency. This regularity may be due to DXers being creatures of habit, or to local conditions such as family obligations, eating and sleeping times, or when electricity is available. Whatever the reason, if a DX station is on the air at a particular time and frequency once, that's an excellent place to look for him again. So peruse "Bandpass" (in *The DX Bulletin*) or "QSN" (in *QRZ DX*) for operating hints. And don't forget any DXpeditions or special operations; they often provide more contact possibilities and better QSL routes than some of a country's regular operators. After all, not every DX station wants to sit and run Ws all day and then face the QSL chores. On the other hand, that's exactly what the DXpeditioner wants. It's the whole reason for the trip so he will be more anxious to pull your call out of the pileup.

Another way to augment your DX scorecard is to hone your DX operating skills, including listening, pileup busting, and tracking down hunt-and-peck stations. And an excellent way to hone these skills when DX is few and far between is to expand your definition of DX.

Expanding Your DX Horizons

With "traditional" DX becoming increasingly hard to come by, alternate definitions of DX serve to keep the DXing spark alive. Among possibilities the DXer might consider is working DXCC on different bands, especially the lower frequencies. (Use this summer to get up some new, more effective DX antennas for these bands.) Another approach would be to chase DX on our new amateur bands: 10 and 24 MHz. Alas, the ARRL Board of Directors won't allow DXCC credit for contacts on these bands (yet), but DX is there, nevertheless. And the new bands are less crowded, with no QSLs to worry about, since they don't count anyway. These new bands offer a pure form of DX the likes of which we haven't seen for years. Think of the opportunities of starting all over again with a new band! (We'll talk more about the new bands in another column.)

Yet another approach to revitalizing your DXing is to chase awards other than DXCC. Many countries offer handsome certificates for various DX accomplishments, such as working all Japanese cities, 100 members of the German DARC,

K5LZO demonstrates one approach to the armadillo, the national bird of Texas.


1986 Armadillo Run Coordinator Tom Taormino K5RC hopes to activate 3077 counties next year.

Russian Oblasts, etc. Or try for the Philippine Worked All United Nations Members award. Since the effective date of contacts for this award is the date of entry into the UN, you'll find you have to go back and work a lot of familiar countries once again to qualify. Contact Pete Peterson K6EDV for more information on this award. Other possibilities include collecting prefixes and Islands on the Air, sponsored by *CQ* magazine and Geoff Watts (82 Belmore Road, Norwich, NR7 0PU England), respectively. Both awards will keep you out of trouble until the sunspots return. Or try starting all over with low power. Modern solid-state rigs perform as efficiently at low power levels as at high power. And the additional effort of making contacts with low power places a premium on operating skills.

Finally, you can completely redefine what you mean by DX. How about Worked All States on 10 meters, starting now? To accomplish this before sunspots make it easy will force you to learn more about propagation, operating methods and techniques, and listening. Or go for 5BWAS, to practice low-band DXing and pileup busting. Worked All States not enough of a challenge for you? Then how about working all 3076 counties in the United States? In 44 hours?

"What!" you say. "All 3076 counties in 44 hours? Ridiculous!" Perhaps to ordinary DXers, but not to the Texas DX Society. This very active group invented the Armadillo Run to battle DX doldrums, and they now propose to enlist the rest of the country in a certified amateur-radio happening.

Jim White K1ZX/4 (right) won the 1983 and 1984 Armadillo Runs.

Armadillo Run

Simply put, the Texas DX Society proposes to activate all 3076 counties over two weekends in 1986: May 3-4 and July 26-27. In celebration of the 150th anniversary of the birth of Texas, the 1986 Armadillo Run will demonstrate ham radio's ability to mobilize quickly, help pull amateur-radio clubs together, and provide a couple weekends of fun for patient DXers and contesters.

The bold idea of activating every county in the US grew out of a 1983 Texas DX Society effort to put all 254 Texas counties on the air. With 12 mobile teams, in 22 hours of operating, the members of the society accomplished this goal, and even gave a trip to the ARRL National Convention in Houston to the winner of the 1983 Armadillo Run. That winner, who worked all 254 counties in Texas in one weekend, was Jim White K1ZX/4. Last year the society expanded the activity to include counties in neighboring states. (Again Jim White took top honors, this time from a horizontal operating position, recovering from an automobile accident.)

So these Texas guys have some experience in these Armadillo Runs. Maybe they can pull it off, with the help of other radio clubs around the country. As an added incentive to Run participants, the society expects the governor of the state to proclaim a new county, Armadillo County, for the duration of the Run! That's like having the League create a country just for one contest!

If you are interested in helping in the Run, contact your local radio club or Run Coordinator Tom Taormina K5RC, Route 1, Box 307, Manvel TX 77578.

Even if you're not interested in the Run, it shows what you can do to keep the DX spark burning when the sunspots aren't. What's your Rx for lackaspots-itis? It may just be the Texas National Bird, the armadillo.

LETTERS

STRAIGHT TALK

Your constant battle with the code requirement is well-received by the many who find this *the* difficult part of the license.

To view code as difficult surely means that the person attempting to learn it has set off on the wrong foot. After all, in WW2 thousands of operators were turned out, sausage-like, in very short order.

If the budding operator is taught using 18-20 wpm right at the start, we would produce operators who could go on the air with some confidence and use very much less time per QSO, thus freeing up band space!

To learn code requires a totally different procedure from that used to learn theory—and *this* may be the problem encountered by so many. It should take no longer than 3 months to get to the 15-plus-wpm level. But you must practice two or three times per day, 7 days per week (no excuses). Each practice period should last about 10 minutes. It's very much like learning to touch-type—it's not how much you do, but how often you do it that counts.

Keying with a straight key (yes, they still exist!) is another operation that is performed incorrectly, quite often resulting in undue fatigue and/or poor sending. The key should be at the edge of the desk, never twelve inches or so back from the edge as is so often shown in instructions. Remember I said *straight key*—it's different for a paddle. Sending is done by moving the forearm down at the wrist, thus dragging the key down. Never push it down or the muscle on top of your arm will grumble! Practice without an oscillator connected for a few minutes until you get the dot-dash relationship clear (by the sound of the key clicks) and you should be all set to go. If your sending deteriorates, stop! You will find that your muscles have tensed up and you are pushing the key down instead of dragging it down.

Please don't say it can't be done—I didn't even want to be an operator, and the army had me doing it for 8 hours on and 8 hours off, 7 days per week, under conditions a lot less comfortable than the average ham shack!

Eric Stabler VE3ISD
St. Catharines Ontario

HUZZAH!

While scanning the March, 1985, issue for some info on RTTY equipment, I came upon the guest editorial, "Stop Playing Around." It struck a chord so loud that I had to write and say "huzzah!"

I have spent at least 6 months per year as ZF2BD in Grand Cayman since 1974, and my operating has diminished almost to the vanishing point. I used to go to the shack every evening for 2 to 3 hours to enjoy long QSOs with people from all over the globe. Though I can hardly be called rare DX, in the past several years it has been almost *impossible* to have a conversation of more than 2 minutes without breakers and the subsequent pileup.

In the early part of each winter season I usually answer 20-30 59-QTHers, but by March or April I turn on the rig, have one short contact (who signs off saying there must be dozens waiting), and say the hell with it and throw the switch and go to bed. Anything short of a 30-minute contact is, as far as I am concerned, to be relegated to contests. I want to know about their wife, kids, interests, occupation, and so on. I don't give *diddly* about their store-bought rig or commercial antenna!

William T. Davin M.D. W9YKT
Glen Ellyn IL

DXPENSES

To Warren Ash AK2H
Kingston NY

Warren, my friend, what a bitter letter ("What Price QSL?," June, 1985). I must admit that I don't understand why you didn't receive a QSL from H44IA, but your rather vicious attack on Bryan Sturm is a bit out of line. I recently received a QSL from him with no problem. I used the IRC system.

It is difficult to nearly impossible for any of us in the States to understand the problems encountered by our brethren in the remote corners of the world. Perhaps his mail from you was pilfered, and the pilferer is attempting a little blackmail on you. Perhaps there are other problems, such as the burden of thousands upon thousands of QSL requests which cost a lot to answer. Perhaps Bryan simply cannot answer them all without a little financial support. After all, my friend, various DX clubs support the cost of QSLing for many DX stations that otherwise would not be able to meet the demands placed upon them.

QSLing is a bit of a luxury, to say the least, and not necessarily a burden that should be placed on the DX operator. After a while they will simply quit operating.

Paul Menard W7KZK
St. Meinrad IN

SIGN IN, PLEASE

For the ham who hasn't spent a dime on new equipment in the past decade, it may be quite a shock to view the interior of a state-of-the-art transceiver, but for the rest of us the sight is all too familiar: circuit boards loaded with chips that often have part numbers which don't seem to cross to any in the 74LSxxx series. And while the design and production of ham equipment has advanced nicely over the years, the same *cannot* be said for the troubleshooting and repair of those rigs.

When I was a youngster, troubleshooting consisted mainly of some basic test equipment and the ability to tell the difference between a good and a bad signal. Now, even if I can find a test probe small enough to fit onto the test point without shorting to something else, the trusty scope display is, more often than not, a jumble of digital signals that confuse me as much as they do the triggering circuit! I threw in the towel. The signals on the scope didn't make sense. There was often no theory of operation in the manual, and the test equipment required to troubleshoot this digital stuff was the same equipment used to design it—in a word, unaffordable.

The whole mess didn't seem to make good economic sense either. Why would any technically-competent ham want to purchase equipment knowing in advance that if anything went wrong with the gear, he stood little or no chance of repairing it past the replacement of lamps and fuses? Wouldn't the owner prefer to deal locally with a problem rather than return defective equipment to an often physically, and even more often psychologically, distant manufacturer? Reality provides the answer. All manufacturers now market sophisticated electronic equipment with "no user-serviceable parts inside." No other choice is available.

But then I discovered a troubleshooting tool that gives the average ham/technician a chance at repairing his own gear again. It really put all that microprocessor stuff in its place and restored my faith in the "one hand/one probe" method of making sick rigs well. With this box, all you have to do is set a few internal switches in the device under test, put the probe on the desired point, read the number that appears on the test instrument, and compare it with a known good reading in the technical manual. Right or wrong—what could be easier?

The method is called signature analysis, and although it has a few limitations, in my opinion it's miles ahead of looking at jittery data on a CRT. The basic theory is to lock the microprocessor into a low-level operation (such as a jump to its own

jump instruction) to provide a repetitive signal on its address and control lines. The signature analyzer then samples this signal, does some math, and produces a unique numeric display which represents the sampled data. Any number other than the correct one indicates a fault and troubleshooting can be done with ordinary techniques such as the "half-split" method, the "good input/bad output" method, etc. At least one manufacturer (Hewlett-Packard) is already making the test device itself, an instrument similar in appearance to a common multimeter.

By now you're probably asking, if this is such a great tool, why aren't manufacturers designing equipment to take advantage of it? Frankly, I don't know. Perhaps there is a bug in the theory that no one has bothered to tell me about. Or it could be that the technique is still so new that producers of electronic equipment haven't had time to finalize their implementations. But I refuse to believe that I am fully informed on the latest technology, so I'm not going to hold my breath. Then again, maybe this is one of those ideas like quadraphonic sound—nothing really wrong with it, but it just didn't catch on.

Lee Hughes WA2VPH
Moravia NY

CONTESTS

CALENDAR

Aug 3-4	ARRL UHF Contest
Aug 17-18	SARTG Worldwide RTTY Contest
Aug 17-19	New Jersey QSO Party
Aug 19-25	Spec-Com North American UHF FSTV Contest
Sep 14-15	ARRL VHF QSO Party
Sep 14-16	Washington QSO Party
Sep 28-29	Late Summer QRP CW Activity Weekend
Oct 5-6	ARRL QSO Party—CW
Oct 6-7	Illinois QSO Party
Oct 12-13	Rio CW DX Contest
Oct 12-13	ARRL QSO Party—Phone
Oct 19-20	ARRL Simulated Emergency Test
Oct 19-20	Jamboree On The Air
Nov 2-3	ARRL Sweepstakes—CW
Nov 16-17	ARRL Sweepstakes—Phone
Dec 7-8	ARRL 160-Meter Contest
Dec 14-15	ARRL 10-Meter Contest

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

SARTG WORLDWIDE RTTY CONTEST
0000 to 0800 UTC August 17
1600 to 2400 UTC August 17
0800 to 1600 UTC August 18

This is the 15th annual contest sponsored by the Scandinavian Amateur Radio Teletype Group (SARTG). Operating classes include a) single operator, b) multi-operator, single transmitter, and c) SWL. Please note that logs from multi-operator stations must contain the names and callsigns of all operators involved. The same station may be worked once on each band for QSO and multiplier credits. Only 2-way RTTY QSOs will count. Use all bands, 80 through 10 meters.

EXCHANGE:

RST and QSO number.

SCORING:

QSOs with your own country count 5 points. Other countries in the same continent are 10 points. Other continents are 15 points. In the USA, Canada, and Australia, each call district will be considered a separate country. Use the DXCC list and the above-mentioned call areas for multipliers. Note that contacts with a station which would count as a multiplier must be found in at least 5 logs or a contest log must be received from the multiplier station in order to be valid. Final score is the sum of QSO points times the sum of the multipliers. SWLs use the same rules for scoring, but based on stations and messages copied.

AWARDS:

Top stations in each class, country, W/K, VE/VO, and VK call district if the number of QSOs is reasonable.

ENTRIES:

Logs must be received by October 10 and should contain: band, date/time in UTC, callsign, exchanges sent and received, points, multipliers, and final score. Use a separate sheet for each band and enclose a summary sheet showing the scoring, classification, callsign, name, and address. In the case of multi-operator stations, include the names and callsigns of all operators involved. Comments will be very much appreciated by the contest committee. Send logs to: SARTG Contest & Award Manager, Jorgen Dudahl-Lasjon OZ1CRL, Egebjergvej 90, 4500 Nykohing Sj., Denmark.

NEW JERSEY QSO PARTY
2000 UTC August 17
to 0700 UTC August 18
1300 UTC August 18
to 0200 UTC August 19

The Englewood ARA invites all amateurs worldwide to participate in the 26th annual NJ QSO Party. Phone and CW are considered the same contest. A station may be contacted once on each band; phone and CW are considered separate "bands" but CW contacts may not be made in phone band segments. NJ stations may work other NJ stations.

EXCHANGE:

QSO number, RS(T), and ARRL section, country, or NJ county.

FREQUENCIES:

1810, 3535, 3900, 7035, 7135, 7235, 14035, 14280, 21100, 21355, 28100, 28610, 50-50.5, and 144-146. Suggest phone activity on the even hours, 15 meters on the odd hours (1500 to 2100 UTC), and 160 meters at 0500 UTC.

SCORING:

Out-of-state stations multiply the number of complete contacts with NJ stations times the number of NJ counties worked (21 maximum). NJ stations count 1 point per W/K/VE/VO QSO and 3 points per DX QSO. Multiply total QSO points by the number of ARRL sections (including NNJ and SNJ—maximum 74). KP4, KH6, KL7, etc., count as 3-point DX contacts and as section multipliers.

AWARDS:

Certificates will be awarded to the first-place station in each NJ county, ARRL section, and country. In addition, a second-place certificate will be awarded when 4 or more logs are received. Novice, Technician, and mobile-operator certificates will also be awarded.

ENTRIES:

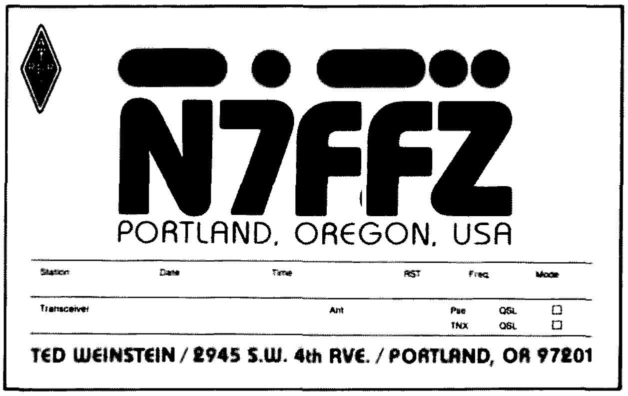
Logs must show date/time in UTC, band, and emission. Logs must be received no later than September 14. The first contact for each claimed multiplier must be indicated and numbered, and a checklist of contacts and multipliers should be included. Multi-operator stations should be noted and calls of participating operators listed. Logs and comments should be sent to: Englewood Amateur Radio Assoc., Inc., PO Box 528, Englewood NJ 07631-0528. A #10 size SASE should be included for results.

NEWSLETTER OF THE MONTH

It's such a pleasure to see a newsletter that obviously has had some thought and care put into it. Bob Ward WA5ROE turns out such a paper; he's the editor of *The Bark*, journal of the Big Bend (Texas) Amateur Radio Club (BBARC).

The Bark is not the largest publication we've seen, nor is it the flashiest. What makes this newsletter stand out among all others is *quality*. Congratulations, BBARC.

To enter your club's newsletter in *73*'s Newsletter of the Month Contest, send it to *73*, 80 Pine Street, Peterborough NH 03458, Attn: Newsletter of the Month.



QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, 80 Pine Street, Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

THE MISSING GLOW

They were our best friends for decades. Their gentle, reassuring glow illuminated our shacks, warmed our hands, and helped us to transmit our signals across oceans and continents. They were as much a part of ham radio as telegraph keys, antennas, TVI, and QRM. We took them almost for granted until one day, almost without warning, they disappeared. The friendly vacuum tube, our companion through countless billions of QSOs, has called its final QRT. Except for use as a CRT and in some high-powered rf amplifiers, the tube has left us.

I got into ham radio during the tube era's very last hurrah. Back in the mid 1960s, tubes were found everywhere: in transmitters, receivers, converters, power supplies, and mostly in hams' junk boxes. In those days, being a True Ham meant knowing your tubes. The weaker among us relied on tube guides and substitution manuals to pick the right devices for their new projects. We True Hams, however, knew that the 6146 was a workhorse transmitting tube. The new, improved 6146A and 6146B versions were even better.

Today, ham radio is transistorized and microcircuited. Things have changed so much that a ham from even as recent a time as the 1950s would be amazed at the revolution in amateur technology. He would probably ask, "Where'd all the tubes go?"

While I realize our hobby must keep up with the times, I can't help but feel that something went out of ham radio the day the last tube rig was manufactured. Just as Brooklyn's decline can be traced to the day the Dodgers left for the west coast, ham radio's recent rough years are no doubt due to the demise of the vacuum tube.

I keep one in my shack just for good luck.

ELEMENT 1
MULTIPLE CHOICE

1) How can you tell if a tube is "gassy?"
   1) By the tube's orange glow
   2) By a bluish glow between the tube's cathode and plate
   3) By shaking it
   4) By listening for the leak
2) Grid-current flow in a class-A amplifier signifies:
   1) A normal operating state
   2) That the tube is being over-driven
   3) That the tube is being under-driven
   4) That the signal voltage is too low
3) What company made "Reliatron" tubes?
   1) RCA
   2) Sylvania
   3) ITT
   4) Westinghouse
4) What company made "Radiotron" tubes?
   1) RCA
   2) Zenith
   3) Sylvania
   4) Grebe
5) Another term for a grounded-grid amplifier is:
   1) grounded-plate amplifier
   2) plate-driven amplifier
   3) grounded-lead amplifier
   4) cathode-driven amplifier

ELEMENT 2
TRUE-FALSE

		True	False
1)	The British term for "tube" is "jug."	____	____
2)	The two elements in a tube diode are the plate and anode.	____	____
3)	A tube grid is usually solid.	____	____
4)	Tetrode and pentode rf amplifier tubes, when used in a receiver, have a very low plate-to-control-grid capacitance.	____	____
5)	The 6146 has three leads connected to its cathode.	____	____
6)	Mercury-vapor tubes are characterized by their soft orange glow.	____	____
7)	In an "inverted tube," the plate receives the input signal and the control grid delivers the output signal.	____	____
8)	In a multi-anode tube, several main anodes operate opposite a single plate.	____	____
9)	Many tubes are also monodes.	____	____
10)	Magnetron tubes are often used at VHF frequencies.	____	____

ELEMENT 3
MATCHING

Match the tube in Column A with the description in Column B.

Column A	Column B
1) 6A8	A) Voltage regulator
2) 2Y2	B) Photomosaic amplifier
3) 5651	C) Beam power amplifier
4) 6F4	D) Metal receiving tube
5) 5727	E) Miniature receiving tube
6) 5998	F) Gas thyratron
7) 7591	G) Series regulator

8) 6AL7GT H) Triode transmitting tube
9) 6C4 I) Half-wave rectifier
10) 12X4 J) Electron-ray indicator
K) Full-wave rectifier

ELEMENT 4
FILL IN THE BLANK

1) The emission of electrons from a tube's filament to its plate is called the _____ effect.
2) Another term for "plate" is _____.
3) Tetrodes have _____ grid(s).
4) Pentodes have _____ plate(s).
5) An orthicon is a type of _____ _____ tube.

THE ANSWERS

Element 1:
1—2, 2—2, 3—4, 4—1, 5—4.

Element 2:

1—False	The British word is "valve."
2—False	Plate and cathode.
3—False	It's usually a wire mesh.
4—True	To help prevent self-oscillation.
5—True	To minimize lead inductance.
6—False	Bluish-green glow.
7—True	The plate is biased negatively and the control grid is biased positively.
8—False	Cathode, not plate.
9—False	Monodes have only one element, a tube has at least two parts.
10—False	At microwave frequencies.

Element 3:
1—D, 2—I, 3—A, 4—H, 5—F, 6—G, 7—C, 8—J, 9—E, 10—K.

Element 4:
1—Edison
2—anode
3—two
4—one
5—TV camera

SCORING

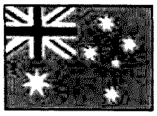
Element 1:
Five points for each correct answer.
Element 2:
Two and one-half points for each correct answer.
Element 3:
Two and one-half points for each correct answer.
Element 4:
Five points for each correct answer.

How did you do?
1-20 points—Your plate supply voltage is out
21-40 points—You've got a grid leak
41-60 points—You're getting warmer
61-80 points—You've been hypnotized by the glow
81-100 points—You're a True Ham

73 INTERNATIONAL

Each month, 73 brings you ham-radio news from around the world. In this collection of reports from our foreign correspondents, we present the latest news in DX, contests, and events, as well as keep you abreast of the technical achievements of hams in other countries.

If you would like to contribute to your country's column, write to your country's correspondent or to 73 Magazine, *Pine Street, Peterborough NH 03458, USA, Attn: Perry Donham KW1O.*



AUSTRALIA

J. E. Joyce VK3YJ
44 Wren Street
Altona 3018
Victoria
Australia

Here are some snippets, cleaning up scrap pieces of info that have gathered on my desk over a period of time, especially appropriate now that my column may appear on a bimonthly basis.

LICENSE FEES

The annual fee for an amateur license in VK is now $A21, plus postage if applicable. This also is the cost for a reciprocal license, no matter how brief may be your stay in Australia.

FORMAL CELEBRATIONS

A number of Divisions are planning to hold formal celebration dinners this year. During November, 1985, the Administrative Council of the IARU will be holding a meeting in Melbourne prior to the IARU Region 111 Conference in New Zealand. At that time, many important IARU dignitaries will be here, and the committee is planning to hold a national reception.

SPECIAL HIGH-SPEED AMATEUR MORSE TESTS

Our DOC will now provide high-speed Morse tests as a permanent service to the amateur fraternity. The main aim is to assist amateurs to obtain a reciprocal license when visiting overseas countries where Morse speed standards are higher than in Australia. Tests at speeds of 12, 14, 15, and 16 words per minute were utilized during the trial period.

The following conditions are applicable to the new arrangements which are now in force:

- Amateur licensees may apply to sit for high-speed Morse tests at any of the department's Radio Frequency Management offices.
- As with all special examinations, these tests will be provided on a mutual-convenience basis. Tests at any reasonable speed above 10 wpm can be arranged, subject to the availability of a suitable qualified departmental examiner.
- High-speed Morse tests will, in general, follow the same system, in terms of format and marking, as the standard amateur Morse examinations. The exception will be that the Morse character/space ratio will be as described in the ITU Radio Regulations. A pass will be awarded to candidates who achieve 10 or fewer errors in receiving, as well as 5 or fewer errors in sending (e.g., 1 letter wrong equals 1 error, 1 figure wrong equals 2 errors).
- An accreditation document attesting to the candidate's ability in Morse at the appropriate speed will be issued to successful candidates.
- A fee of $20 per test will be applied, in view of the one-off nature of these tests. This fee reflects a realistic balance between the costs of providing the service and its value to interested persons. The level of the fee will be reviewed from time to time.

SCHOOL BOOK PACKS

While the events mentioned above are for existing amateurs, we also are looking to the future by introducing amateur radio to secondary school students.

As this year has been proclaimed the Year of Youth, an event which is sure to gain much more public interest than "World Communications Year," what better time to bring our pastime to the attention of the youth of Australia? As a starter, we are negotiating to make available, at cost price, special amateur-radio Book Packs, which can be purchased by bona fide groups and clubs for presentation to schools. At present, it appears to have great potential for new amateurs (and therefore, future members) as well as providing another bridge between amateurs and the public.

The WIA also is hopeful of running a contest during this year for non-amateur students, with some important prizes being donated by a significant *Amateur Radio* magazine advertiser.

VK8—LADIES

There should be, in the near future, some VK8 YL operators as at the last Novice course conducted by the VK8 Radio Club, 50% of the applicants were young ladies. I hope some pass, as I, personally, have never heard a VK8 YL on the air.

CORDLESS TELEPHONE BAN

The Australian government has banned the import of cordless telephones not approved for use in Australia. Industry and Commerce Minister, Senator John Button, has changed customs regulations due to the import of a large number of cordless telephones which did not comply with DOC regulations. He said the telephones interfered with television reception, and that those using high power also could cause interference to aviation communications.

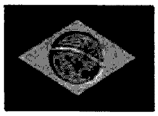
SPECIAL ENVELOPES

On May 22 this year, our Postal Department issued a special commemorative pictured envelope featuring amateur radio and commenting on the fact that the WIA was celebrating 75 years of existence and was, in fact, the world's oldest national amateur-radio club.

The envelope is quite striking in appearance, featuring an old-type CW key in the foreground, behind which is a circuit diagram of an early radio transmitter. Above this is a dish antenna, plus headphones superimposed over a map of the world showing how amateur radio spans the globe.

The stamp printed on the envelope depicts a radio operator wearing headphones and speaking into a microphone. This is superimposed over lines of amateur VK callsigns. (I looked, but mine's not there; curses!)

In all, very colorful, and good PR for both the WIA and amateur radio in general.



BRAZIL

Gerson Rissin PY1APS
PO Box 12178 Copacabana
20000 Rio de Janeiro, RJ
Brazil

SAO PAULO COUNTIES

To get a few Brazilian awards, rules for which we already published here, it is necessary to work as many as possible different cities in the state of Sao Paulo, the most populated state of Brazil. However, many of those cities don't have amateurs living there. Those awards, sponsored by the Brazilian CW groups, are available only for QSOs in CW.

So, trying to help us, two friends, Francisco Muller PY2RRG and Oswaldo Martinez PU2SCR decided to operate every Sunday from a different spot, specially along the coast of their state. In this way, they have already worked from Itaquacetuba, Biritiba Mirim, Mongagua, Salto, Elias Fausto, Caraguatatuba, Suzano, Mairipora, Reruibe, Poa, and Ferraz de Vasconcelos. Once in a while they return to a city already worked from before.

The operation is only on fifteen and forty meters and the usual frequencies are 21.030 MHz and 7.030 MHz. The equipment includes a Kenwood TS-180S, a Yaesu FT-101ZD, two QRP transceivers of about 10 Watts, and dipole antennas. The QSL information for PY2RRG/PY2 or PU2SCR/PY2 is PO Box 44329, Sao Paulo, SP, 03696, Brazil.

THE 1984 WORLDWIDE (CW) SOUTH AMERICA CONTEST

The WWSA Contest is sponsored by Grupo Editorial Antenna, and its rules were published in this column in April, 1985. Winners of the 1984 WWSA contest are shown in Figs. 1 and 2.

RENATO COSTA PT7AI

During my trips to northeast Brazil, due to my job, sometimes I have a chance to see friends who I never thought I'd meet personally. One of them was Renato Costa PT7AI. He is retired (and very proud because he is now a great grandfather). Renato was licensed only a few years ago, and since then he has become an avid DXer. He has 142 countries worked, most of them confirmed.

He's a very charming person—and don't lose the opportunity of a QSO when

Renato Costa PT7AI.

Band	DX Station	South American Station
1.8 MHz	K1ZM	PY1BVY
3.5 MHz	OK2HI	CX8DT
7 MHz	DK3KD	LU4FC
14 MHz	DJ2PJ	PP2BT
21 MHz	EI3DP	PY1APS
28 MHz	DL3ME	LU2DGZ
Multiband	HA7KSR	PT2KT
Multi-operator	OK3KII	CX7BY

Fig. 1.

Continental Winners

Single Operator	Multi-operator
Africa: EA5YU/EA8	Asia: JA6YAI
Asia: JH0BBA	Europe: OK3KII
Europe: HA7KSR	South America: CX7BY
North America: K8CW	
Oceania: KH6WT	
South America: PT2KT	

Fig. 2.

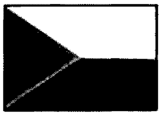
you hear him. QSL via PO Box 546, Fortaleza 60000, Ceara, Brazil.

GRGJR AWARD

Sponsored by the Boy Scout Amateur Radio Group Joao Ramalho, the GRGJR Award is available to all licensed amateurs for confirmed contacts with 3 (three) GRGJR members and 5 (five) different Brazilian prefixes (PY1, PY3, PP6, PY7, PS8, etc.). Contacts must have been made after March 1, 1984, on any amateur band and in any mode. No QSL. Send GCR list of stations worked (call, date, time, band, mode, and report) and 10 IRCs for mailing expenses to GRGJR Award, PO Box 466, 09500 Sao Caetano do Sul, Sao Paulo, SP, Brazil.

GRGJR members: PY2GJR, PY2CAR, PY2KQ, PY2EJ, PY2PNA, PY2ORK, PY2RTW, PY2AU, PY2DTR, PY2MDU, PY2RSF, PY2OWE, PY2NG, PY2GPA, PY2RG, PY2ON PY2MM, PY2VA, PY2CY, PY2ZY, PY2ASI, PY2FKF, PY2NYS, PY2LEV, PY2EHL, PY2USM, PY2UMV, and PY4PZ.

Francisco Muller PY2RRG.



CZECHOSLOVAKIA

Rudolf Karaba (OK3KFO ARC)
Komenskeho 1477/8
955 01 Topolcany
Czechoslovakia

EME IN CZECHOSLOVAKIA

In the last ARRL EME contest, station OK1KIR made 45 contacts altogether, and by 36 multipliers gained 162,000 points. In the 145-MHz band, the operators of the station used a 4 x 10 yagi antenna (according to PA0MS) and they had contacts with DL8DAT, SM2GGF, K1WHS, WA1JXN/7, KB8RQ, and YU3WV, and they heard 25 other European and North American stations.

On 433 MHz they made contacts with JA6CZD, G4EZN, F1FHI, HB9G, YU1AW, DL9KR, N4GJV, WA1RWU, N9AB, WB5LUA, F2TU, K2UYH, I5MSH, WB0TEM, KD6R, VE4MA, DJ6MB, F9FT, F1FAN, G3LTF, OE9XXI, G3SEK, DF3RU, and EA2BK, and heard 20 other stations.

In the 2320-MHz band, they made contact with OE9XXI and heard only (559) WA4HGN, which was using a parabola with a diameter of 8.5 meters with a transmitter output of 400 Watts, and with W4HHK (539) that had a transmitter with the same output and a parabolic antenna with a 5.5m diameter. The signals of both stations were stable, without any fadings.

In the past I mentioned the station I0SNY several times in connection with its multiple breaking of the world record in the 10-GHz band. This time it broke the world record in the 24-GHz band at the end of August last year, when Nicola, after his previous experiments for the distances of 350 and 90 kilometers, agreed with the amateurs in the Calabria experiments with an advantageous route from the south of Italy to the island of Ischia near Neapol [Naples].

In connection with this advantageous route, it is necessary to mention that in its total distance of 331 km there was a distance of 40 km in its middle part in which the curved sea level obstructed the direct distance. In Calabria, there was a group of amateurs on Montalto (1956 meters high) in locator HY70j (JM78WE) and they were working under the callsign O8YZO/8. I0SNY was on Ischia in locator GA3Oa (JN6OWR) above sea level by 788 meters. Although there wasn't direct visibility between the stations, it was supposed that an over-water ducting would be in the 24-GHz band just as by experiments recorded in the 10-GHz band. It also was confirmed, although with some problems, and thus the contact was kept for several hours by telegraphy, operating F2.

Both sides used metal-laminate parabolas and Gunnplexers with outputs of 30 mW. Automatic tuning of the frequency was by varactor diode HA4E 115, and the receivers had noise figures of 6 dB.

AMSAT-OSCAR 10 ACTIVITY

A couple of operators, OK2BX and OK2VTD, were boasting about their activity through AO-10-B. Zdenek OK2BX and Jozef OK2VTD were using the following setup: a vertically-polarized 10-yagi antenna to the receiver, the antenna amplifier with 3SK112, the transceiver according to DJ6HA, the teleprinter converter DK1AQ, and the machine RFT T-51; a 21-element yagi antenna for the transmitter, the transmitter Klinovec with the transverter on 435 MHz and PA (power amplifier) 20 W.

A perfect list of teleprinter signals of the beacon GB and an announcement about their finishing of AFSK for the transmitter were enclosed with their letter. The first Czechoslovak teleprinter contact through AO-10 has already become a reality. Also, Jenda OK2EH has sent a few lines about his work. Since the end of April till the beginning of October last year, he had made 150 contacts on CW with 56 DXCC countries. He mentions that the first contact during his first experiments would have been successful earlier if he had been able to find his own signals in the downward route! A changed "solar angle" (being changed between −60° to +60° during a 7-month period) was confusing him. The output of a solar battery that is at its largest value at 0° is connected with this fact. The operational schedule is updated periodically and announced telegraphically by beacon GB and also on RTTY.

GREAT BRITAIN

Jeff Maynard G4EJA
10 Churchfields
Widnes WA8 9RP
Cheshire
England

Like most of Europe, the UK is keen to promote the adherence to band plans, particularly in the VHF and above allocations. This is not to impose some kind of bureaucracy on active amateurs but to ensure that good sense prevails and that everyone has a fair share of the space available.

There are, of course, those vociferous minorities who cry "foul" at any attempt to regulate what ideally should be a freely-available resource. These protesters fall into two broad categories—the anti-rule brigade and the "I'm right" brigade.

The anti-rule people are opposed to band planning for essentially ideological reasons. They do not think that anybody (least of all the RSGB) has any right to impose an arbitrary set of constraints on a frequency spectrum that, in technical terms at least, is fully available. These are the people who think they must demonstrate their point of view by ignoring any set of rules or plans.

Thus, you will hear an SSB CQ being called in the middle of the designated FM subband. Needless to say, the call is not answered and only serves to annoy somebody trying to stick to the rules. I suspect this same group of people would be ardent supporters of band planning if the official view was that no band plans would be defined.

The second group of people is much more dangerous (to society at large—not just to radio hams). These are the people who, for example, decry FM as not being "proper radio," and therefore seek to deny its adherents any frequency space. (You also get, of course, those opposed to RTTY, to SSTV, to SSB, *particularly* to repeaters, and so on.)

Any licensed ham is free to choose the modes or bands he wishes to use. No ham is, to my knowledge at least, forced to adopt any particular method of operating against his wishes. This is how things should be, but merely not liking something does not make it wrong. I have no objection to the ham who has CW QSOs only—but equally he has no right to deny my interest in, say, RTTY.

The multifaceted nature of amateur radio has much to do with its attraction to a great many of its fans. It is precisely this variation that sensibly leads to the development of band plans. I do not think that band planning is an imposition on the way I operate. On the contrary, it gives me a good idea where to look for particular types of signals or where to go to avoid another type.

The UK band plans are specifically devised to provide an ordered framework within which everyone has the opportunity to do his own thing. I wish this philosophy could be applied to some other aspects of my daily life.

The two most important band plans

Moonbounce	144.000	432.000
CW calling	144.050	432.050
MS CW reference	144.100	
SSB calling	144.300	432.200
MS SSB reference	144.400	
SSTV calling	144.500	
RTTY calling	144.600	432.600
Data fx calling	144.675	432.675
FAX calling	144.700	432.700
FM calling	145.500	433.500

Table 1. Spot frequencies for 2m and 70 cms.

144.000	CW only
144.150	SSB and CW
144.500	All modes
144.845	Beacons
145.000	FM repeater inputs
145.200	FM simplex channels
145.600	FM repeater outputs
145.800	Satellite service
146.000	Band edge

Table 2. 2m band plan.

432.000	CW only
432.150	SSB and CW
432.500	All modes
432.800	Beacons
433.000	FM repeater outputs
433.400	FM simplex channels
434.600	FM repeater inputs
435.000	Satellite and ATV
438.000	ATV
440.000	Band edge

Table 3. 70-cm band plan.

Channel	Input	Output
R0	145.000	145.600
R1	145.025	145.625
R2	145.050	145.650
R3	145.075	145.675
R4	145.100	145.700
R5	145.125	145.725
R6	145.150	145.750
R7	145.175	145.775

Table 4. 2m repeater allocations.

Channel	Output	Input
RB0	433.000	434.600
RB1	433.025	434.625
RB2	433.050	434.650
RB3	433.075	434.675
RB4	433.100	434.700
RB5	433.125	434.725
RB6	433.150	434.750
RB7	433.175	434.775
RB8	433.200	434.800
RB9	433.225	434.825
RB10	433.250	434.850
RB11	433.275	434.875
RB12	433.300	434.900
RB13	433.325	434.925
RB14	433.350	434.950
RB15	433.375	434.975

Table 5. 70-cm repeater allocations.

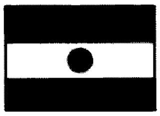
(and the ones I will describe in detail) are for 2 meters and 70 cms. Each plan nominates a number of spot frequencies as well as defining areas of each band for particular types of emission.

Spot frequencies (see Table 1) are given for calling in most modes (CW, SSB, FM, RTTY, SSTV, FAX, data, etc.) and there are definitions for MS and moonbounce working and reference. A particular 2m frequency (145.525, channel S21) is nominated for broadcasts of GB2RS, the RSGB service.

Tables 2 and 3 show the broad divisions of each of the bands according to mode. The major difference is in relation to repeater input/output pairings. In the 2m band, repeater outputs are 600 kHz above their respective inputs, whilst in the 70-cm band, repeater outputs are 1.6 MHz below their respective inputs. Tables 4 and 5 show the repeater input and output frequencies and their channel designations.

Channel numbers are also allocated to the simplex channels that fit, in each band, between the repeater input and output frequencies. Simplex channels are spaced, like repeater channels, at intervals of 25 kHz.

Two-meter simplex channels are from 145.200 (numbered S8) through to 145.575 (and numbered S23). The FM calling channel is known as S20 (145.500). Seventy-centimeter simplex channels are from 433.400 (SU16) to 433.600 (SU24). The 70-cm FM calling channel is 433.500 (SU20).



INDIA

Miss R. Subha
3 Thiru-Vi-Ka Road
Post Box 725
Madras 600 006
India

INDIA'S ONLY BLIND HAM

A small village a hundred miles away from Madras, served by a feeder-route bus service, had the unique privilege of having been the destination of the largest number of hams ever to have visited an Indian village. This little place—Chatram—cannot be found even on the district map, but it is known to most 40m operators, DX and Indian, as the home of India's first and only blind ham, VU2TTC.

Chakravarthy, popular on the band as Chak, lost his sight due to detachment of the optic nerve shortly after taking his Master's degree in mathematics. Disabled but not defeated, he took up electronics as a hobby and soon was on the doorstep of amateur radio. The Amateur Station Operator's Certificate (ASOC) examination appeared insurmountable, but he solved problems as they arose. Learning of radio theory and regulations, he managed with the help of his nephew, Govindarajan, who read out loud to him. He learned Morse code through a Morse-code record given by the late VU2GW and cassettes from VU2MO.

During the learning period, Chak had joined the Madras Amateur Radio Society, which interacted with the licensing authority (WPC) and obtained permission for him to use his nephew as a scribe. Govindarajan would read out the question and Chak would reel off the answer, which was faithfully transcribed. Two WPC officials stood by to make sure that the high-school-going nephew did not add his own wisdom to the answers.

Chak came out with flying colors and in due course (generally a year in this country) he was assigned his callsign, VU2TTC. Where to find a rig? Those were the days before liberalization, and one had to build or smuggle in equipment. Chak built a single-frequency crystal-controlled QRP transmitter and used it with a Philips domestic 3-band transistor receiver. His first contact was with VU2MKS on 7010 kHz on March 9, 1979.

After a while, VU2APS helped him build a rig with an 807 final and a vfo. In the first two years, Chak ran up an impressive total of 10,000 contacts, local and DX, all on the 40-meter band in CW and AM modes!

VU2TTC is today a byword among the SWLs in this part of the country, to be found on the 40-meter band every morning, ready to have QSOs with newcomers taking their first hesitant steps or old-timers trying to test their top CW speed. A teacher by profession, Chak readily helps all newcomers with advice and tutoring in radio theory and Morse code.

Chak recently had a pleasant experience. He received a used Yaesu FT-7 as a gift from Steve DJ1US. Though he anticipated difficulties in clearing the gift through customs, it was surprisingly smooth sailing, thanks to VU2MV who accompanied him to the customs office. The customs officers were nice enough to deliver the parcel to him at Madras instead of sending it along a further 100 miles through the mails.

At the time of writing this, a linear to go with the FT-7 is on the way as a gift from Kazu JJ1TZK; Chak can look forward to allband operation in the near future.

If you hear VU2TTC, please do have a word of appreciation for a man who has not allowed blindness to stand in the way of meaningful, active life—something unusual in this part of the world.

Photos by 4Z4MK

Drawing winning raffle tickets at the hamfest. Left to right, Tuvia 4X4GT, IARC treasurer, Naomi 4X6DW, secretary and hamfest organizer, and Yankele 4X4AH.

ISRAEL

Ron Gang 4Z4MK
Kibbutz Urim
Negev Mobile Post Office 85530
Israel

THE BAR ILAN HAMFEST—THE OLD-TIMERS REMEMBER

On Saturday evening, March 30, 1985, the Israel Amateur Radio Club held its annual hamfest and social gathering in the banquet hall of the Bar Ilan University near Tel Aviv. Among the highlights were a buffet, a display of the latest gear from the Israeli distributors of Kenwood and Yaesu, a raffle of gear ranging from handie-talkies to computer accessories, and the awarding of prizes to the winners of the recent IARC QSL card contest.

The main feature of the evening was the calling up to the podium of a number of seasoned old-timers who recounted tales of their experiences in ham radio in the pre-state days and the early period of the independence of our country.

The first to speak was Shlomo "Sioma" Manzari 4X4BX, who told that in the days of the British Mandate of Palestine, ham radio was strictly forbidden, the holding of transmitting equipment considered a criminal offense punishable by death. Nonetheless, the amateurs organized themselves, issuing themselves Palestine callsigns. Shlomo was "assigned" ZC6SM. He recalled that a friendly British officer, a ham, brought them their QSL cards from the RSGB.

In 1948, when the state of Israel was proclaimed, the government at first did not want to allow ham-radio operations. Arguing with the authorities, the hams stated that they had not feared the British hangman's noose previously, and should they not be granted licenses, they would continue their operations clandestinely. As we know, the amateurs won out, the first 4X4 calls were issued, and Shlomo became the first president of the new Israel Amateur Radio Club.

Froike 4X4AF brought down from his attic a box of memorabilia which included a license granted by the British authorities to operate a shortwave receiver, stipulating a maximum antenna length and height of 30.5 meters, and stating that exceeding these directions would result in criminal proceedings. Of course, Froike operated as ZC6AF. He displayed QSL cards from

Shoshana Kirschner 4X6OL and Aharon 4X4AT, IARC president.

Froike 4X4AF shows QSLs from the early days of Israel's independence.

Jordan, Syria, and Saudi Arabia, indeed rare prizes, and a card from ZC6JM, the station of the American Consulate in Jerusalem.

Yankele 4X4AH had a different kind of experience on the air in the days prior to Israel's independence. Working with a nationalist group, he set up an ARC-5 Command Set transmitter with a carbon microphone and originated twenty-minute broadcasts to the general public, changing locations for each transmission.

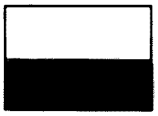
The affair went without a hitch for about a year, until one day, five minutes into the broadcast, one of the group burst into the room from which they were broadcasting in Tel Aviv to say that they were surrounded by British soldiers and police. To this day, Yankele thinks that someone informed on them, as in those days direction-finding equipment was most primitive, and there is no way they could have been DFed in such a short time.

Yankele and his friends were arrested, and as a punishment, Yankele was exiled to British prison camps in Eritrea and Kenya, being allowed to return home only once the state of Israel was proclaimed. Yankele enlisted in the Israel Defense Force's Signal Corps, where his boss was Joe Berr 4X4AA. Yankele was bitten by the ham-radio bug, and soon earned his first amateur-radio license.

Shimshon 4X4GF (Gefilte Fish) was a member of the pre-state underground Hagana forces that were concerned with the bringing in of refugees from Hitler's death camps in Europe, running the British blockade of the then-Palestine coast. He became a wireless operator in the Hagana net that coordinated the illegal immigration operation. Like Yankele, when Israel gained independence, Shimshon was bitten by the ham bug, and the bands have never been the same since.

For many of the hams present, these stories were a living history lesson. Today we all take ham radio for granted, yet the stories of the old-timers here brought back a period that today is difficult to imagine.

Special thanks go out to Naomi 4X6DW, who worked very hard to organize and see through this hamfest. A few hundred amateurs plus their XYLs, YLs, or OMs were present, and the sale of raffle tickets bolstered the club's treasury substantially, so that financial support for the coming year's activities is ensured.



POLAND

Jerzy Szymczak
78-200 Bialogard
Buczka 2/3
Poland

At the beginning of September, 1984, the central radio station of PRAA (Polish Radio Amateurs Association) began to transmit broadcasts of information and to establish contacts separately from the Radio Information Bulletin of PRAA, on every Sunday at 1030 local time on 3700 kHz (SSB) and 7060 kHz (AM). Furthermore, informative SP5PZK broadcasts are transmitted every Wednesday at 1700 local time on 3700 kHz. Broadcasts of PRAA include the latest news, announcements from PRAA headquarters, advisory service, accounts of hams' ventures, and technical information.

After the broadcasts, operators of SP5PZK establish contacts with radio amateurs and provide reports on broadcast audibility, wait for information concerning all radio amateurs, and answer questions. At first, SP5PZK establishes contacts with foreign stations, and next with SP in a district order. Radio station SP5PZK has been installed in the PRAA Office (Warszawa Jaracza 2) and uses transceiver TS-520 and delta-loop antenna for shortwave. Simultaneously for local receivers there are broadcasts on 144 MHz FM with radiotelephone FM-302 and an omnidirectional antenna with vertical polarization.

The oldest, most active DX Club of PRAA commemorated its 25th anniversary in 1984. The club was founded by SP7HX, SP3PL, SP8CK, SP5HS, and SP2AP on June 9th, 1959. During its 25 years of existence, members of the club met each other at 15 rallies in different locations in Poland. The 16th rally took place in Bocheniec near Kielce on October 6-7, 1984. Over 130 members, would-be members, and friends of the club heard a presentation of the outgoing president, SP9ZD. He gave an account of the 25 years of activity of the club and discussed some real organizational problems.

Constant issuances of licenses was a topic for discussion. Proposed amendments to laws regulating hams' activities in Poland, new proposals for extension of radio amateurs' rights relative to new bands of SW, and mobile and portable modes were other subjects of discussion. Transmission and reception demonstrations on CW and RTTY with a minicomputer, by SP5DED, aroused great interest among the participants.

SP9CTW reported results of Intercontest KF 1981. 224 SP stations entered, of which 180 were classified as individual. The champion of Intercontest in mixed and phone categories was SP9HWN; in category CW—SP6FER, and in the club radio station category—the SP2PDI team.

The next XVII rally of SPDX Clubs will take place in 1985, if a district board of PRAA undertakes resolving hardships.

On January 20, 1985, from 0800 till 1000 local time, Polish RTTY contests were arranged by the district board of PRAA in Leszno, on 3.5 MHz, call "CQ SP."

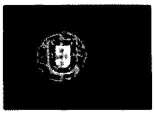
The best Polish stations that took part in OKDX Contest 1983 were:

- Single op, multiband—SP5GIQ; 1.8—SP3GVX; 3.5—SP8EMO; 7—SP4EEZ; 14—SP7MGD; 21—SP2NA; 28—SP6BFK.
- Multi-operator, multiband—SP8ZHY.

The best Polish stations that took part in PACC Contest 1984 were:

- Single op, multiband—SP5EXA, SP6AEG, SP3LPR
- Multi-op, multiband—SP9KJT, SP7KTE.

The best Polish SWL in this contest was SP93110KA.



PORTUGAL

Luis Miguel de Sousa CT4UE
PO Box 32
S. Joao do Estoril 2765
Portugal

This time you will read about a DXpedition organized by a few Portuguese hams during the last WPX contest, in March. It was to the island of Berlenga, a beautiful place surrounded by water which is nice and clear; there is not any sort of pollution down there. We also cannot find any medieval architecture (HI), but an old but nice lighthouse can be seen.

Our thanks to Luis CT4NH who kindly sent us the following report:

Myself and CT4UW, we've been thinking about repeating the operation from Berlenga Island, still with the very special call, CT0BI. We decided together with the others to make the first-ever serious multi-multi effort from CT-land, during the CQ WPX SSB Contest!

For success, we had almost all the necessary ingredients: one island, a rare prefix, and a fantastic team composed of Joe CT1AOZ, John CT4UW, Joe CT1BOH, and the author (CT4NH) with the precious help of our old friend Commander Patricio (Portuguese Navy Officer). Weather conditions were very good on the west coast of Portugal—only a few windy days.

We installed, after a routine voyage, 4 stations with their antennas, and CT1AOZ, with his Machiavellian (and efficient) system on 160 meters. The island has outstanding conditions for Top Band. I was just active on 40m; on 20 and 80 we had CT1BOH, and on 10/15, CT4UW.

But Murphy was there!

Power on the island was about 170 volts instead of the 220 ac necessary as a minimum for the linear amplifiers (Drake/Yaesu), with great variations! Then, just 20 minutes before the contest started, I heard CT1BOH shouting, very excited, "I've no antenna! Oh, that Murphy!" The wire had come down with the strong winds. Everybody ran upstairs (I mean more than 300 steps) to the top of the lighthouse in the deep night to replace the antenna!

Well, after that, our multi-multi was started at 0010 precisely, by CT1BOH, with very very poor propagation except on 20.

I think CT1AOZ worked everybody around 160m! (Some of them twice.)

Other minor problems included CT4UW's TH3JR disintegrating in the wind—but replaced because we also declared war on Mr. Murphy (HI HI).

Excellent meals were prepared by Commander Patricio, who got a nice tan in the bright sun of this marvelous island while we worked up a very nice score (we hope): QSOs totals:

1.8 MHz—350	14 MHz—2000
3.5 MHz—370	21 MHz—380
7.0 MHz—300	28 MHz—0

Believe it or not, propagation was in very bad shape on 28. Our total score was 697 prefixes.

We hope sincerely to be there next year to give you the opportunity to work Berlenga Island and receive its marvelous QSL card. Contacts with CT0BI are valid for the IOTA Award, having for this purpose the reference EU-40.

The QSL manager for this operation is CT4UW, and the QSL cards might be sent via *Callbook* address.

VISITORS IN LISBON

Last April we had Frank Rose W1TIV from Cape Cod, Massachusetts. Frank and Irene were here in my shack for a while. Next time I write I will bring you more news about Frank's trip.

73 from Portugal and good DX.

WPX Contest on Berlenga Island last March. Left to right, John CT4UW, Joe CT1AOZ, Commander Patricio, Luis CT4NH, and Joe CT1BOH. (Photo by CT4NH)

SWEDEN

Rune Wande SM0COP
Frejavagen 10
S-155 00 Nykvarn
Sweden

THE FIELD AWARD

The Board of the Swedish Amateur Radio Society, SSA, has taken the decision to issue The Field Award to licensed radio amateurs for verified contacts with, and to shortwave listeners for verified reports from, other radio amateurs in a number of fields. These fields are defined by the Locator System adopted by IARU as of January 1, 1985 (The Maidenhead Locator). Contacts on or after this date are valid for The Field Award.

The Field Award is issued for verifications of fields in four classes:

Platinum—	All 324 fields
Gold —	300 fields
Silver —	200 fields
Bronze —	100 fields

All bands for amateur radio and all modes are permitted. No endorsements will be issued. All contacts must be made with stations on the surface of the earth. The contacts shall be verified by regular QSL cards or equivalent, on which the field is clearly stated (or the position, with such accuracy that the field can be determined). The term "position" refers to longitude and latitude or to the name of a place or a town.

If there is any uncertainty about a field, SSA may require additional information

before approving the contact. If the uncertainty remains, the contact will not be approved for the award.

The application shall be made on a GCR list, containing the information from each QSL card which is required for approval. The GCR list shall be verified by the award manager or other official of the national amateur society in the country of the applicant. A random sample of individual QSL cards may have to be made and sent to SSA for checking, if requested.

The fee is 30 Swedish kronor, 10 IRCs, or $US4.00; the application address: The Field Award Manager, Sveriges Sandareamatorer (SSA), Ostmarksgatan 43, S-123 42 Farsta, Sweden.

WORLD ATLAS

Folke SM5AGM, the father of the world locator system (The Maidenhead Locator), has produced a world atlas (field map) which enables you to determine the field of the station worked. This world atlas should be available at your national amateur-radio society or can be ordered from SSA at the address above by sending a large size (A4) SAE and 6 IRCs. A presentation of SM5AGM and his work with this locator system will be made in a future column.

7S-SSA SPECIAL-EVENT STATIONS

This year of 1985, Sveriges Sandareamatorer celebrates its 60th anniversary. The Swedish licensing authority gave the SSA the opportunity of using the very rare 7S prefix for this occasion during the period April 26 to May 31, 1985. Various radio clubs were part of this activity by being able to use the special call for certain club activities for a few days each. There was one special call on the air from each of the 8 call areas, i.e., from 7S1SSA to 7S7SSA and 7S0SSA. If you have worked all 8 special-event stations you may apply for a "Worked All 7S Award." The license for this special prefix was issued on April 23.

DEALER DIRECTORY

PROPAGATION

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA						20	20					
ARGENTINA	20	20	20	40			20	20	15	15	15	15
AUSTRALIA		20	20	20	40	40	20					
CANAL ZONE	15	40	40	40	40^1	40		15	15	15	10	10
ENGLAND			40^1	40			20	20	20	20	20	20
HAWAII			20		40		20					
INDIA												
JAPAN						20	20					
MEXICO	15	40	40	40	40^1	40		15	15	15	10	10
PHILIPPINES							20					
PUERTO RICO	15	40	40	40	40^1	40		15	15	15	10	10
SOUTH AFRICA			40	40		20	20				20	
U.S.S.R.							20	20		20		
WEST COAST	20	40	40	40^1	40^1	40						20

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA		20	20					20	20			
ARGENTINA	15	20	20	40			20	20		15	15	15
AUSTRALIA	15	20	20	20	40^1	40		20			20	
CANAL ZONE	15	20	20	20	40^1	40	20	20	15	15	15*	10
ENGLAND	20	40					20	20		20	20	20*
HAWAII	15	15	20	20	20	40	20	20				
INDIA												
JAPAN		20	20					20	20			
MEXICO	15	20	20	20	40^1	40	20	20	15	15	15*	10
PHILIPPINES		20	20				20	20				
PUERTO RICO	15	20	20	20	40^1	40	20	20	15	15	15*	10
SOUTH AFRICA							20				20	20
U.S.S.R.								20			20	

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA		20	20						20			
ARGENTINA	15	20	20	40	40			20	20		15	15
AUSTRALIA		20	20	20	20	40^1	40^1		20		15	15
CANAL ZONE	15	15	20	20^1	40^1	40		20	20	15	15	15
ENGLAND	20							20	20			20
HAWAII	20	15	15	20	20	20^1	40^1	40	20		20	20
INDIA				20					20			
JAPAN		20	20						20			
MEXICO	15	15	20	20^1	40^1	40		20	20	15	15	15
PHILIPPINES				20					20			
PUERTO RICO	15	15	20	20^1	40^1	40		20	20	15	15	15
SOUTH AFRICA			40						20			
U.S.S.R.									20			
EAST COAST	20	40	40	40^1	40^1	40						20

1 = Possible 80-meter openings.
*** = Check next higher band.**

G = Good, F = Fair, P = Poor.

AUGUST

SUN	MON	TUE	WED	THU	FRI	SAT
				1 G	2 G	3 F
4 P	5 P	6 F	7 F	8 P	9 P	10 P
11 F	12 F-G	13 G-F	14 P	15 P-F	16 G	17 F
18 F-G	19 G	20 G-F	21 P	22 P	23 P	24 P-F
25 P	26 F	27 F-G	28 G	29 P	30 P	31 P-F

OUR 300th ISSUE!

September 1985
$2.50 USA
$3.50 Canada

73 for Radio Amateurs

A CWC/P Publication

International Edition

1985's Hottest Antennas!

ARRL:
"Give Novices SSB"

What SWR Really Means

SPECTRUM CRISIS: Too Many Repeaters?

73 for Radio Amateurs®

ISSUE #300 SEPTEMBER 1985

On the Cover:
David Smith N1BBD secures a 20m beam during the K1XR 1985 Field Day effort. Photo by Frank Cordelle, Bennington, New Hampshire. Above (l to r): Craig Clark N1ACH, Lenny Goodnow WA1UNN, and David Smith N1BBD.

4 **What?**
7 **QRX**
65 **Barter 'N' Buy**
65 **Special Events**
69, 77 **Ham Help**
70 **RTTY Loop**
70 **Fun!**
71 **Be My Guest—Crisis**
71 **Letters**
72 **Satellites**
73 **Be My Guest—ARRL**
74 **New Products**
76 **Review**
83 **Contests**
86 ***73* International**
92 **Above and Beyond**
94 **Dealer Directory**
94 **Propagation**
95 **List of Advertisers**

12 **Again, the CCD**
The continuing story of ham radio's most amazing antenna. KC8BN/7

17 **The Downunda Project: Part II**
How to assemble and align the DSE 2m transceiver described last month. .... Simpson

26 **Fighting Fire With Wire**
If 15m is hot and your antenna's not, try the V-bomb array. W6TYH

30 **Brew a Coffee Ground Plane**
No cream, no sugar—just a 440 antenna that really percolates. WA2OVG

32 **Takin' It to the Streets—Part I**
Work the world from your HT! Crossbanding expert WA6AXX explores the how-to of remote and auxiliary operation. WA6AXX

38 **Build the Broadband Bow Tie**
It's every ham's dream: An 80m antenna with a flat swr of 1.5:1 from 3.5 to 4.0 MHz. And it couldn't be simpler. WD9ELG

40 **Don't Fall for Swr Fraud**
Your feedline may be swindling you. Find out how much power you are losing and how to stop it. W1GV

42 **Whip the Competition**
Improve your 2m HT's "mileage" with this custom antenna from Datsun! N3DRW

44 **Exponential Potential**
The problem: A broadband antenna fed with coax exhibits narrowband response. The solution: Use this exponential-line matching system. W6TYH

50 **Wheatstones Are Not Crackers!**
Here's the slickest application of the Wheatstone circuit yet devised. The Nuller Bridge is the only instrument you'll need to adjust your antenna matching unit to peak performance. K4KI

54 **A New Angle for Dipoles**
Stand them on end! Sounds odd, but W1GV presents an excellent case for HF vertical dipoles. W1GV

58 **Six for Two**
Get range-tested 12-dB gain for under $5! K.C. Jones engineered this 2m delta beam for maximum bang per buck. KA8RCJ

62 **Dr. Frankenstein's CB Beam**
Ravage the countryside with ten-meter rf! Create your antenna with refuse from the Citizen's Band graveyard. KA3JOM

Editorial Offices: Pine Street, Peterborough NH 03458, phone 603-924-9471 **Advertising Offices:** Elm Street, Peterborough NH 03458, phone 603-924-7138. **Circulation Offices:** Elm Street, Peterborough NH 03458, phone 603-924-9471 **Manuscripts:** Contributions in the form of manuscripts with drawings and/or photographs are welcome and will be considered for possible publication. We can assume no responsibility for loss or damage to any material. Please enclose a stamped, self-addressed envelope with each submission. Payment for the use of any unsolicited material will be made upon acceptance. All contributions should be directed to the *73* editorial offices. "How to Write for *73*" guidelines are available upon request. US citizens must include their social security number with submitted manuscripts. **Subscription Information:** Rates in the United States and Possessions: One Year (12 issues) $24.97; Two Years (24 issues) $38.00; Three Years (36 issues) $53.00. Elsewhere: Canada and Mexico—$27.97/1 year only, U.S. funds. Foreign surface mail—$44.97/1 year only, U.S. funds drawn on U.S. bank. Foreign air mail—please inquire. To subscribe, renew or change an address: Write to Subscription Department, PO Box 931, Farmingdale NY 11737. Send Canadian changes of address to: 73, PO Box 1051, Fort Erie, Ontario CANADA L2A 5N8. Return postage guaranteed. For renewals and changes of address, include the address label from your most recent issue of *73*. For gift subscriptions, include your name and address as well as those of gift recipients. For questions concerning your subscription and to place subscription orders, please call us toll free at 1-800-645-9559 between 9 am and 5 pm or write to *73*, Subscription Department, PO Box 931, Farmingdale NY 11737. *73 for Radio Amateurs* (ISSN 0883-234X) is published monthly by CW Communications/Peterborough, Inc., 80 Pine Street, Peterborough NH 03458. Second class postage paid at Peterborough NH 03458 and at additional mailing offices. Canadian second class mail registration number 9566. Microfilm Edition—University Microfilm, Ann Arbor MI 48106. Postmaster: Send address changes to *73*, Subscription Services, PO Box 931, Farmingdale NY 11737. Nationally distributed by International Circulation Distributors.

Gary Rennie KC8BN/7
9124 E. Glencove
Mesa AZ 85207

and it is quiet on receive compared to a regular half-wave inverted vee at the same altitude.

I have no way to determine the radiation angles other than to accept what W4FD and W4ATE wrote in their articles. The darn thing works! The CCD compares equally with my home-brew half-wave dipoles on received signal strength but is superior when receiving weak signals and signals with QSB. I am amazed, in that I must be radiating a mix of both high- and low-angle signals.

My construction was quite simple. I used about 423 feet of #14 insulated house-wire stock for the wire sections. I fed it in the center and constructed the center insulator out of a junk 3/8″-thick hunk of schedule-40 PVC plumbing clamp. One could use probably any strong plastic just so it can support the weight and the pull of the elements and the feedline. The feedline was 70 feet of the best 300-Ohm TV twinlead Radio Shack has (with the foam dielectric). Not having an amplifier, this would work fine and is easier to mount than open-wire line. The TV twinlead with 100 Watts out can handle any mismatches with use of an antenna tuner and be reasonable in terms of losses.

The insulators for the capacitor/resistor networks were 1-1/2″-long sections of 3/4″-diameter PVC pipe (see Fig. 1). After construction, these insulators were filled with clear GE silicone caulk to encapsulate the components for weather protection. Locating the silver-mica caps was the longest project. I found prices as high as $1.25 each to 12¢ each. It pays to shop! The voltage ratings of my caps

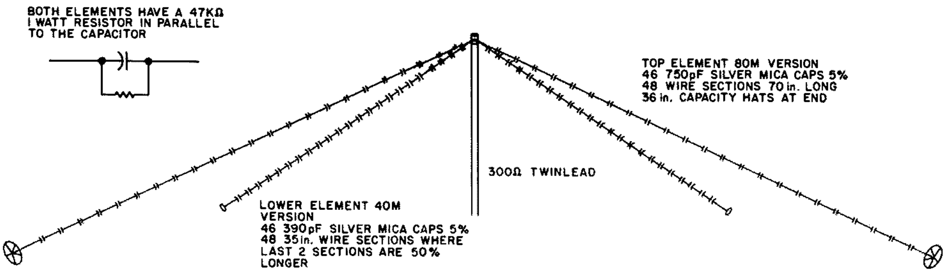


Fig. 2. The 80/40 CCD schematic.

So again (see Fig. 2), the 80-meter element has 46 750-pF caps, 46 47k-Ohm, 1-Watt resistors, and 48 wire sections each 70 inches long. The 40-meter element has 46 390-pF caps, 46 47k-Ohm, 1-Watt resistors, and 48 wire sections each 35 inches long. Actually, the last wire sections of the 40-meter element are 50% longer to help with the current flow out to the tip. The 80-meter element I constructed has 36″-diameter hats for the ends to serve the same purpose. The hats and/or the extended last sections are not really needed for operation, but the authors of the articles do say they will improve the performance of the CCD antenna.

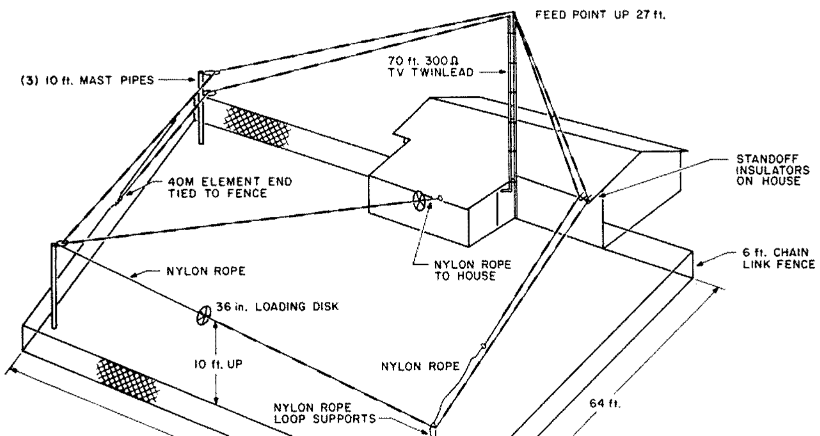
The installation was the fun part (see Fig. 3). I have a 27-foot push-up mast mounted on my house. My backyard has a 6-foot chain-link fence around it, so I clamped the three 10-foot mast pipes to it. With the total mounting area being about 80′ × 64′, I had to be creative!

It ended up like the drawing. Two thirds of the full-wave 80-meter CCD is 10 feet off the ground and only 3 to 4 feet from the metal fence! Yet I worked VKs and ZLs on 80 (with the band open)! The 40-meter element just inches under the 80-meter element was luckier. I'd say about 60% of it is up between 10 and 27 feet (somewhat like a conventional inverted vee).

Most people I contact who are interested in the CCD antenna say they do not have the room. Phooey! I would say my city-size lot is average for urban dwellers, and the neat thing about the CCD antenna is that it is unbelievably tolerant of your creativity! (Now to get the neighbors and XYL tolerant—HI, HI!)

An added plus with the general-coverage feature of my TS-430S, like many of the newer rigs, the CCD setup I use works excellently on those other bands for receive. Remember we have here a very broad high-pass filter of an antenna, with extended aperture.

To build a CCD takes some soldering time, accurate measurement, and thought about designing insulators and mounting. Do not be afraid even to wrap the thing around your house, like going under a roof overhang, if you are in a "no antennas" area. The thing will work! It just totally reverses what we learned about the half-wave dipole. No high supports? Again give the CCD a try and you'll be amazed and on the air. You may end up like me and find it everywhere! ■



Leo Simpson
140 Joynton Avenue
PO Box 227
Waterloo NSW 2017
Australia

The Downunda Project: Part II

How to assemble and align the DSE 2m transceiver described last month.

Editor's note: Part I of this article appeared in the August, 1985, issue of *73*. Reprinted with permission from *Electronics Australia*.

While the circuit of the new VHF transceiver is relatively complex, its construction is reasonably simple and does not require any special assembly techniques. A soldering iron and a screwdriver are virtually all you need. Make sure the iron has a small chisel-shaped bit for quick and effective soldering.

Most of the circuit components, with the exception of front-panel and rear-panel hardware, are accommodated on a single-sided printed circuit board (PCB) measuring 162 × 199 mm and coded with the Dick Smith Electronics type number ZA1687. The front and rear panels are also made from PCB copper laminate and are soldered at right angles to the main PCB.

The whole PCB assembly fits (and that is the operative word) into a specially designed ABS case which has two interlocking halves secured by four screws. It is a neat and effective assembly.

As can be seen from the photo, the front panel has white silk-screened labeling on a black background. This is combined with an attractive set of knobs and other hardware plus a backlit signal/power meter to produce a professional-looking transceiver.

Construction Aids

All purchasers of this transceiver kit will receive a detailed assembly manual which describes construction on a step-by-step basis. The parts layout diagram comes complete with a grid pattern and you simply insert each part in turn at the grid location and cross it off the parts list.

In addition, the main PCB will be supplied with a screen-printed overlay as seen in Fig. 2. The copper side of the board also has a solder mask to reduce the possibility of solder bridges.

Board Preparation

Before actually mounting any of the components, a certain amount of work on the PCB is necessary. The first job is to remove a 3-mm strip of solder mask from the ground pattern at either end of the PCB. This is best done by masking off each 3-mm strip with masking tape and then removing the solder mask using a cotton ball dipped in nail polish remover.

Alternatively, the solder mask can be scraped off using a sharp utility knife.

Constructors should also inspect the board very closely to see if the solder mask has encroached onto any of the mounting holes of the components. Check also that all component holes have in fact been drilled and that there is no evidence of bridging in the copper pattern. None of these faults may in fact be present, but it is better to spot them now rather than try to find them when most of the soldering is complete.

It may also be necessary to slightly enlarge the mounting hole for power transistor Q22. This transistor is mounted and soldered on the underside of the PCB and secured by a stud which passes through the board.

Q22 requires a clearance hole of 10 mm so that its seating plane can pass right through the PCB and butt up to the aluminum heat sink. More on that later.

PCB Assembly

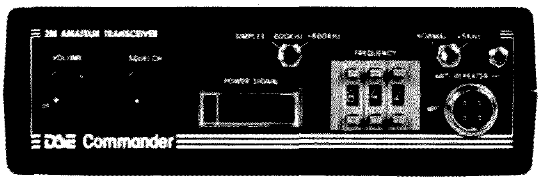
We are now ready to commence assembly of the PCB. Begin by installing the PC stakes and wire links. The wiring diagram (Fig. 3) indicates where most are required. Additionally, four PC pins are required as a foundation for the oscillator enclosure and as locating points for the front and rear panels.

The four PC pins for the oscillator enclosure and ground pin for Q21 should be fitted from the copper side of the PCB so that the longest end is through the PCB.

The use of PC pins for the external wiring is optional but we recommend it. PC stakes make it so much easier to disconnect and reconnect wires if that becomes necessary.

There are 13 wire links on the PCB and all except one of these are labeled "LK" on the overlay diagram. The exception is near C158. This one is shown but not labeled on the diagram. In addition, note that one of the links should be insulated (near D33).

With the job of installing the PC stakes and wire links



The DSE Commander two-meter transceiver kit.

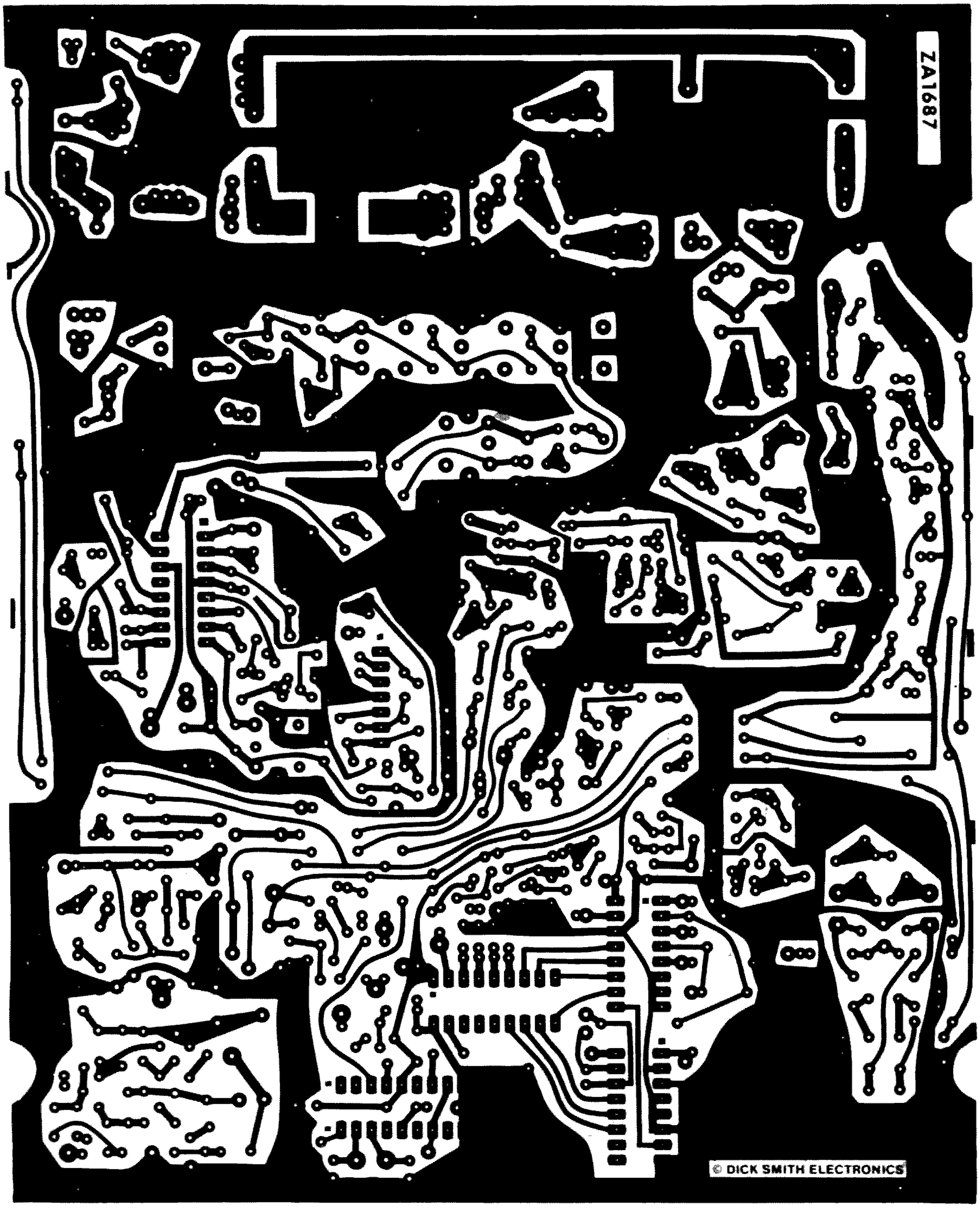


Fig. 1. Circuit board, foil side.

complete, there is now the longer task of installing all the resistors and capacitors.

Keep Those Leads Short

The most important point to remember when installing all these small components is that the pigtails should be kept as small as possible. Because the circuit is working at very high frequencies, any long component pigtails will act as unwanted inductors and play havoc with the performance.

Quite a few of the resistors have to be stood "on end" to fit them in. When this is done the clearance between the end of the resistor body and the PCB should be around 1 mm. It is a good idea to install these vertical resistors with the color code running down the body. It is easier to check the resistor values in this way.

R111 (100k Ω) should not be installed before FL3 and Q8 are inserted and soldered. It loops over these two components.

Little comment is required with regard to mounting the capacitors except that you must use the capacitor type specified. There are no ifs or buts here. Do not interchange green caps (i.e., metallized polyester) for ceramics or tantalums for normal electrolytics (or vice versa).

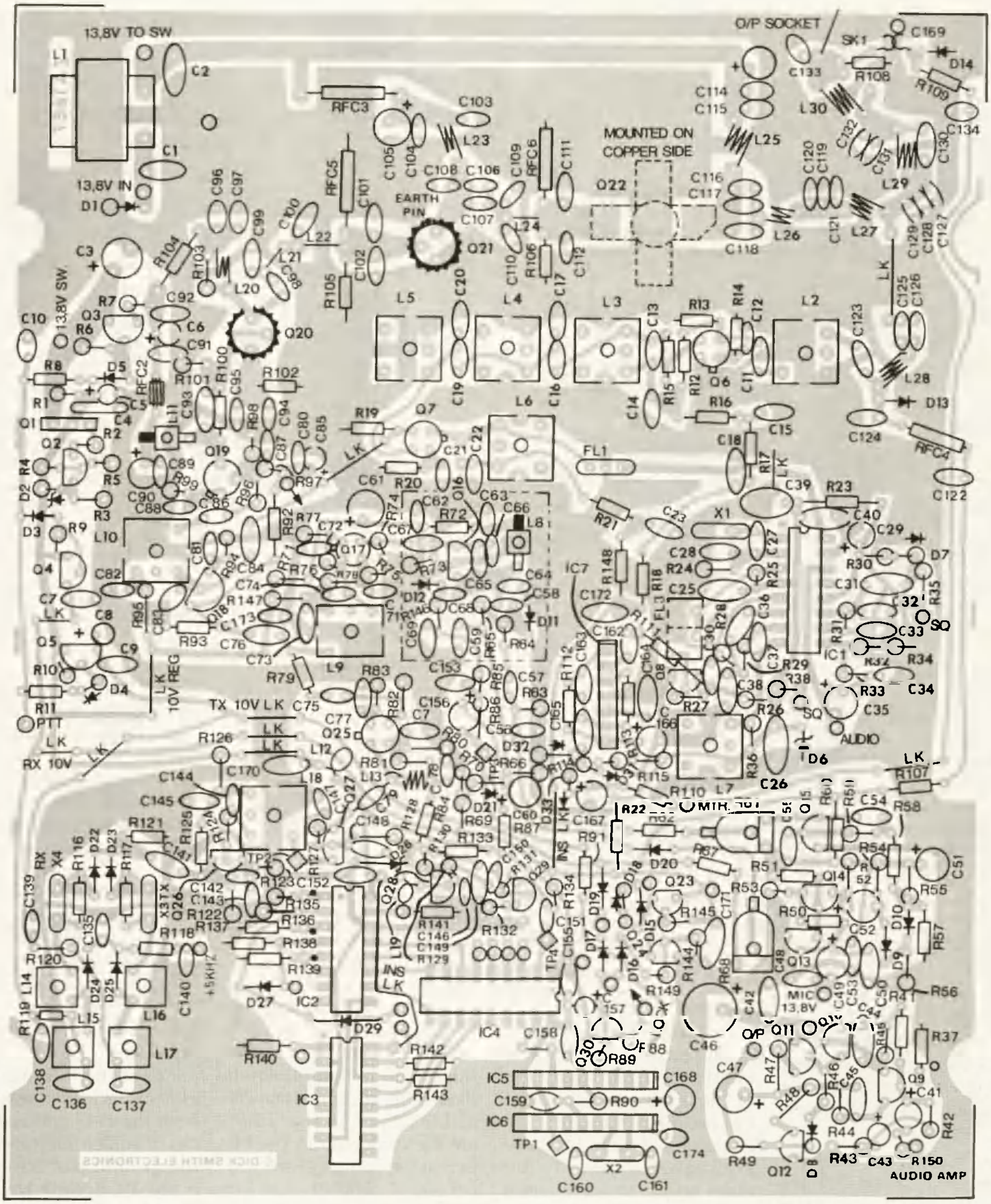


Fig. 2. Parts placement guide.

C169 is a couple of light-duty insulated wires twisted together. The amount of twist is adjusted (sounds very precise, doesn't it?) during the calibration procedure.

Semiconductors

The semiconductor complement is 33 diodes, 30 transistors, and seven integrated circuits. With the total of 70, it might seem a lot, but don't hurry the task to get through it quickly.

Mount the diodes first and again the pigtails should be kept as short as possible. Take particular care with the diodes that are mounted "on end." Make sure that the polarity is correct. Remember that once you have soldered and clipped the leads you will not be able to reuse the diode if you find it has been installed the wrong way around.

Pay particular attention when installing diodes D22, D23, D24, and D25. The cathode end of these diodes is indicated by the red band. The yellow and orange bands make up the code which indicates the diodes' type number.

D14 is installed with cathode end up and anode to PCB ground. It is part of the pickup (including "gimmick" capacitor C169) for the meter circuit.

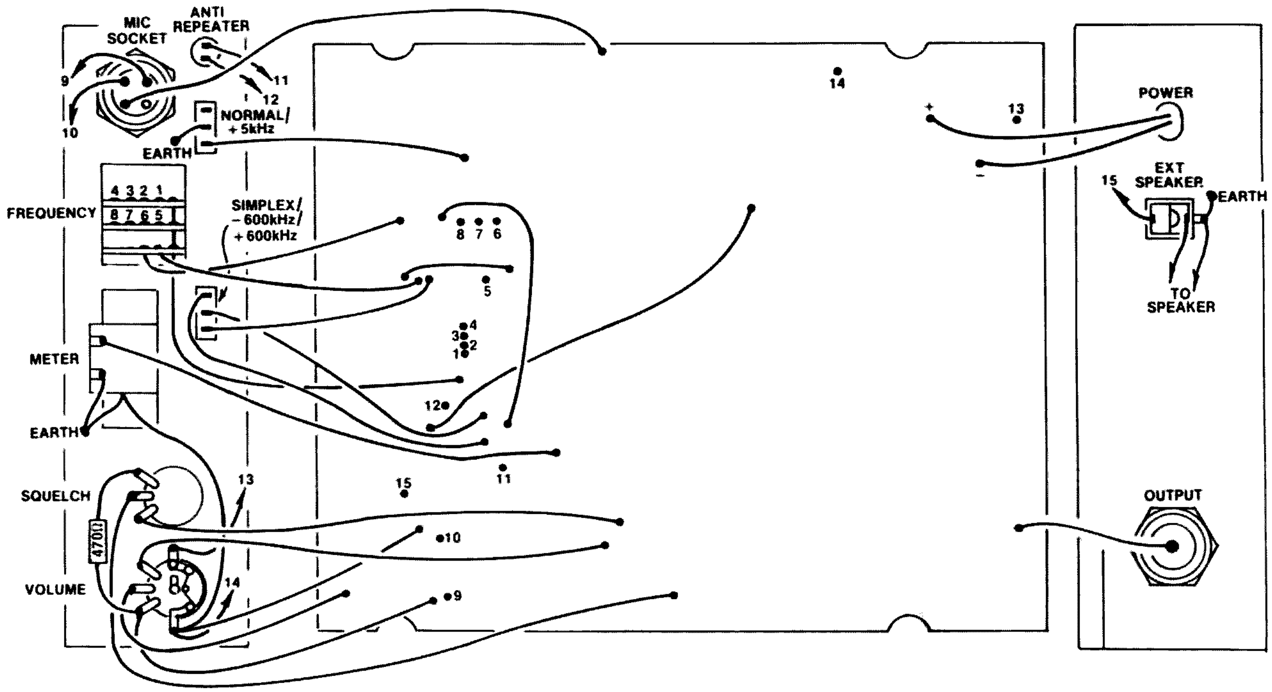


Fig. 3. Wiring diagram.

Care is also required when mounting the transistors to ensure correct lead orientation. Double-check each transistor against the circuit diagram before soldering it into the circuit. All the small-signal plastic-pack transistors plus the metal-encapsulated TO-18 types (Q6, Q7, Q17, Q25) should be mounted so that the transistor bodies are about 3 mm above the surface of the PCB.

In practice, this simply involves pushing the transistors down onto the board as far as they will go without placing undue strain on the leads (and on your fingertips).

The TO-39 metal-package transistors, Q20 and Q21, are mounted flat against the PCB. The metal case of Q21 must also be grounded by soldering it to a PC pin which should already have been installed. Clip-on heat sinks are also fitted to Q20 and Q21.

As already mentioned at the start, Q22 is mounted on the copper side of the PCB. It has four brass tabs which are soldered directly to the PCB copper pattern. Make sure it is correctly oriented before soldering.

The integrated circuits require little comment apart from the two that are CMOS. These are IC2 and IC3, the 4560 decimal address. These should be soldered while the iron has its barrel connected to the PCB ground pattern via a jumper lead. Solder pins 16 and 8 of IC2 and IC3 first, and then the remaining pins.

Inductors

By now you are ready to begin installing the various rf transformers and coils. Ten of these have to be wound by you, the constructor. The necessary details of these are shown in Table 1. The main points to watch here are that you must use the correct gauge of wire for each coil and that the coils are wound exactly to specification.

Note that the hairpin coils, L21 and L24, must be dimensioned exactly as called for in the table.

Coils L8 and L11 are supplied already wound and must be installed the right way around. If you closely examine the red plastic form for each coil you will notice that one side of the form has a long vertical rib while the other has a short vertical rib. In the case of L8, the long rib should be adjacent to L6. In the case of L11, the long rib should be closest to Q1, the BD140.

Assembly of the main PCB can now be completed by installing the filters, the four crystals, and the preset pots.

Finally, it is necessary to shield the vco to prevent spurious radiation into adjacent circuitry. Supplied with each kit is a strip of double-sided PCB laminate which should be cut into four 28-mm lengths. The four strips are then soldered to the PC pins at the corners of the vco circuit.

Final Assembly

Attention can now be turned to the front and rear panels. These are supplied with the necessary cutouts for all the hardware, and assembly is really very straightforward. For example, the frequency-selector switch just clicks into place and has its own built-in retaining system.

Leave the heat-sink assembly and meter off at this stage. Note that R37 (470 Ω) is strung between the outside lugs of the volume and squelch pots, as depicted in the wiring diagram.

With the hardware fitted, slip the front and rear panels into their respective mounting slots in the case and mount the main PCB using the four self-tapping screws provided. The PC pins at the front and rear of the main PCB are now soldered to the end panels and the case fully assembled to make sure that everything fits.

Adjust the PCB assembly as necessary, then remove it from the case and run a series of solder fillets between the ground pattern of the main PCB and the end panels. This provides strength and rigidity.

With this done, the rest of the assembly can be completed. Install the heat-sink assembly for Q22, which is composed of a short channel extrusion and a single-sided heat sink for the rear panel. These are secured using screws and nuts supplied with the kit. Finally, complete the wiring according to Fig. 3.

Alignment

This is quite a straightforward process, although you do need access to some test equipment: (1) a digital multimeter, (2) a dummy load, e.g., DSE cat. D-7027, (3) a 5-MHz (or better) oscilloscope, and (4) a digital frequency meter.

Initial Settings

1. Set the core of L18 flush with the top of the can.
2. Set the core of L9 two turns down from the top of the can.
3. Set the core of L10 one turn down from the top of the can.
4. Set the slugs of coils L8 and L11 one turn down from the top of the form.
5. Set VR68 to ¼ clockwise rotation.

Voltage Checks

Connect the transceiver to a 13.8-V-dc power supply and make the following voltage checks:

1. Without switching on the unit, check that the input voltage is 13.8 V dc. This voltage can easily be measured between the switch contact on the volume control and ground.
2. Switch on (without microphone connected) and check for +10 V dc at the collector of Q1 (allowable tolerance 0.5 V).
3. Check for +10 V dc at the emitter of Q4 (allowable tolerance 0.5 V).

Synthesizer Alignment

1. Check TP1 (Test Point 1) for 10-kHz clock frequency at 6 V p-p (approx.). Measurement for TP1 can be easily taken from under the PCB at pin 7 of IC6.
2. Check TP2 (output from L18 offset oscillator) for rf output. Use a sensitive rf probe or test probe as depicted in the inset in Table 1.
3. With oscilloscope on TP4 (mix-down frequency), located at IC16, and the dc meter with the positive probe to TP3, adjust L8 (vco coil) for 2.5–2.7 V at 144 MHz.

L13	25 B&S En/Cu 1/8 in. (3.2mm) DIA CLOSE WOUND	4T
L20 L30	18 B&S En/Cu 3/16 in. (4.7mm) DIA. CLOSE WOUND	2 1/2T
L23 L25	18 B&S En/Cu 17/64 in. (6.7mm) DIA. CLOSE WOUND	1 1/2T
L27 L28 L29	18 B&S En/Cu 17/64 in. (6.7mm) DIA. CLOSE WOUND	2 1/2T
L22	18 B&S En/Cu 17/64 in. (6.7mm) DIA.	1T
L24	18 B&S En/Cu 1/4 in. (6.4mm) DIA.	HAIRPIN
L26	18 B&S En/Cu 3/8 in. (9.5mm) DIA.	1T
L21	25 B&S TIN/Cu 1/8 in. (3.2mm) DIA.	HAIRPIN
RFC2	FERRITE BEAD 25 B&S En/Cu	2T
RFC3	6-HOLE FERRITE CHOKE 25 B&S TIN/Cu	

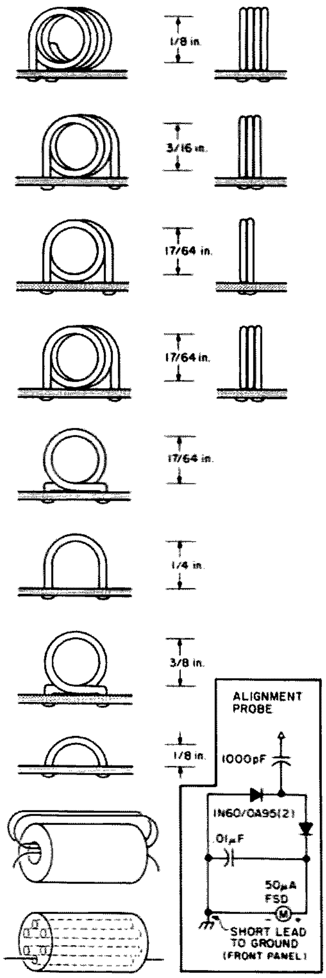


Table 1. Coil construction details.

4. TP4 should show a signal of 600 kHz at approximately 2 V p-p (simplex—144 MHz). (Minimum level of 1 V p-p and maximum level of 2 V p-p nominal.)
5. Adjust L18 (offset oscillator) for maximum amplitude at TP4.
6. Select 147 MHz. The dc volts at TP3 should increase to approximately 5 to 6 volts. The oscilloscope on TP4 will show a level greater than 1 V p-p at 3.6 MHz.
7. Select 146 MHz (simplex). Connect a dummy load to the output. The dc volts at TP3 should be 4–4.5 volts. Now press the PTT button for a short period and adjust VR68 for 4–4.5 volts as measured above.

Receiver Alignment

1. With no signal input, adjust L7 for maximum noise in speaker.
2. With suitable signal source (i.e., signal generator or a hand-held transceiver held near a radio, etc.), adjust L2, L3, L4, L5, and L6 for maximum reading on the signal meter, reducing input as required to obtain half-scale reading. This should be performed at 146 MHz (center band). Your local repeater, slow Morse beacon, or propagation beacon can be used.
3. With a known input frequency, adjust L6 and L7 for best sound (best audio quality).
4. With an accurate input frequency of 146.005 MHz and the +5-kHz switch on, adjust L14 for best audio quality. (A separate 2-meter transceiver using a dummy load and in close proximity can be used.)
5. With an accurate input frequency of 146.000 MHz, change the switch from +5 kHz to normal and adjust L15 (receiver frequency adjustment) for best audio quality. Please note that the +5 kHz must be adjusted first, and then the normal frequency, as these adjustments will interact.
6. At this point, with a calibrated signal, the sensitivity of the receiver should be better than 0.5 µV for 12 dB Sinad.

If minor receiver instability is experienced, change R12 from 10k Ω to 12k Ω. This is due to the variation in gain of the rf amplifier, Q6.

Transmitter Alignment

1. Align at 144 MHz simplex.
2. With a suitable load and frequency counter connected to the output socket, press the PTT button and monitor the input current. Rf output should be available.
3. At 144 MHz simplex, adjust L9 for maximum rf output. Note that this is a critical adjustment; once adjusted, do not alter it.
4. Then adjust L10 and L11 for maximum rf output (still at 144 MHz simplex).
5. At this point, the rf output should exceed 10 Watts.

Approximate current drain is 1.9 A at 10 W and 2.2 A at 15 W.

6. Now select 147 MHz and press PTT. Rf output should be the same as that in step 5, and no adjustment is required. (No tuning is required due to the broadband power amplifier.)

Transmitter Frequency

1. Set normal/+5-kHz switch to the +5-kHz position. Set frequency to 146 MHz, then press PTT, making certain that both frequency counter and dummy load are connected to the output. Then adjust L16 for 146.005 MHz.
2. Switch the normal/+5-kHz switch to the normal position and adjust for correct

frequency (i.e., 146.000 MHz).

Transceiver Modulation

1. With a suitable modulation meter or monitor receiver, adjust VR61 for 5-kHz peak deviation. The setting for 5-kHz peak deviation should be approximately ½ rotation of VR61.

This should be adjusted at 146 MHz simplex (center of band range).

2. Adjustment of twist capacitor C169: With dummy load connected to output, press PTT and adjust C169 by tightening or loosening turns to achieve 90% FSD on the signal/power meter in the transceiver.

Waxing the Vco

Once the alignment has been completed, the vco enclosure can be filled with wax to ensure mechanical stability and prevent microphonics. The procedure is as follows:

1. With 144 MHz selected, check voltage at TP3. Note this reading.

2. Using your soldering iron, melt a liberal coating of transformer wax (supplied) onto the various components in the vco but do not cover coil L8 at this stage.

3. When cool, readjust L8 for the voltage reading previously noted, then use the transformer wax to seal L8.

In some cases, where high ambient noise forces the use of high volume from the internal speaker, microphonics may still occur despite the shield and the wax. If this occurs, the best way around the problem is to use an external speaker.

Construction of the VHF transceiver is now completed. ■

A complete kit is available for $149 plus postage and handling from Dick Smith Electronics, PO Box 2249, Redwood City CA 94063.

Harry D. Hooton W6TYH
1420 Shamrock Lane
Lincoln CA 95648

Fighting Fire With Wire

If 15m is hot and your antenna's not, try the V-bomb array.

Today, the propagation on the high-frequency amateur bands—particularly the 15-meter band—is wild, to say the least. Excluding the WWII years, I have been on the air continuously for over 56 years and have never experienced such erratic and unpredictable propagation conditions as those occurring at this time. Nevertheless, the contacts, brief as most of them are, can be very interesting and exciting. This article is addressed especially to those hams who have joined the ranks over the past few years and may not be very familiar with the vagaries of HF-band radio propagation as we pass through the periodic sunspot minimum.

The newer ham should make himself familiar with the normal action of the various ionospheric layers involved in sky-wave propagation of radio shortwaves. The wild propagation prevalent on the 15-meter band at this time is probably due to sporadic-E refraction. In case you are not familiar with this term, it refers to patches of relatively intense ionization—ionized "clouds" of varying intensity and size, moving, appearing, and disappearing at random.

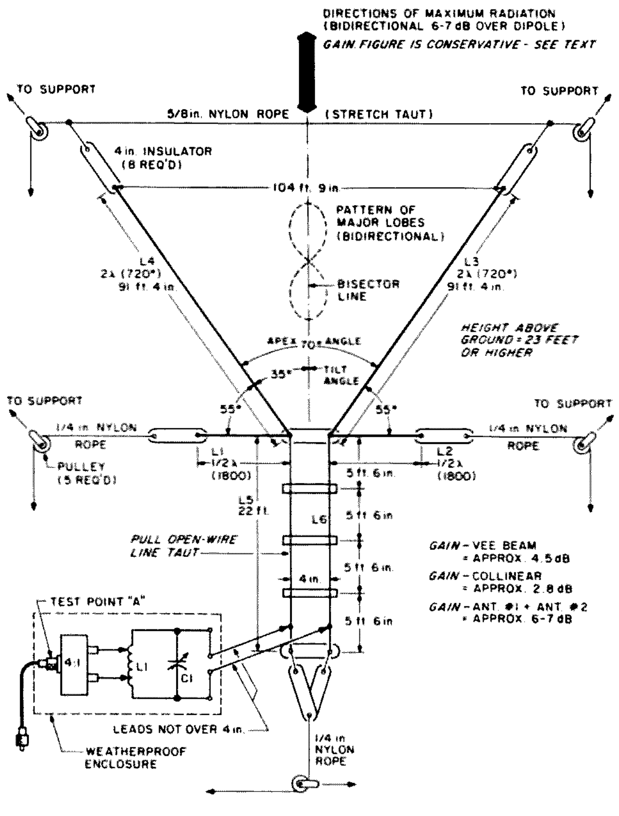


Fig. 1. W6TYH combination array for 15 meters.

At times, the intensity of ionization in a sporadic-E patch is much higher than that of the normal E layer. When this happens, the radio wave is refracted from the electrical cloud and the signals, usually at a distance of 1200 to 1500 miles, are for a short time in the "dB over nine" category. Because the cloud is moving, often rapidly, the exceptionally strong signal can in a matter of minutes (or seconds) drop to a very low value or completely disappear. When the station that you are working suddenly goes out like a light, the chances are that the propagation is due to sporadic-E conditions.

To be most effective for long-distance (DX) communication during periods of sunspot minimum, the angle at which the incident radio wave approaches the ionosphere must be low. When the angle of the incident wave is lowered to approximately horizon-range conditions, the critical frequency is about twice that obtained at 90 degrees.

The critical frequency varies with the ionization density of the ionospheric layers. At this time, most of the DX contacts will be made by amateurs who not only have selected the proper antenna, but also, through their knowledge of propagation characteristics, will be able to take advantage of favorable conditions as they occur. How can we lower the angle of the incident wave? How can we increase the effective DX gain of the popular simple arrays?

High-Gain Design

Most radio amateurs today use factory-built multiband rotary beam antennas placed on the top of high towers, often at great heights. After 56 years of ham radio, I am often amused at the shock expressed by the ham at the other end of the circuit when he is informed that the antenna at W6TYH is a wire beam fed with an open-wire transmission line. In the minds of most modern hams, wire antennas went out with Marconi.

There is also a widespread belief that to construct a high-gain wire array one needs a space as large as the Sahara Desert. A short V beam (two wavelengths or so on a leg) will be effective for most DX work on 15 meters, but it is greatly improved by adding a pair of half-wave wings as shown in Fig. 1.

I am afflicted with a terminal illness—a pulmonary condition that does not permit much physical activity. While in the hospital, I passed the time toying with

the idea of installing a V-beam array stretched between three large oak trees surrounding my ranch house. As soon as I was physically able, with the aid of a couple of teenagers, pulleys and ropes were installed in the trees at about the 40-foot level. Then the V beam was installed and performed very well in the two directions along the bisector line. However, it was desired to increase the gain of the array and to lower the radiated vertical angle of the bi-directional pattern. Obviously, another V section placed under the first one, spaced from 3/8 to 1/2 wavelength (free space) would increase the gain by 3 dB, but what about the vertical angle?

At this time we got the idea of adding a broadside curtain and driving the two systems in phase. The first idea was to hang the curtain section on the nylon rope across the open end of the V. However, this would require a very long feedline to the curtain and possibly a great deal of experimental work to make sure that the two systems were actually operating in phase. Finally, we realized that if the feedpoint of the broadside section was connected in parallel with the feedpoint of the V array, the two sections, V and broadside, would be driven perfectly in phase (0° phase difference) and no tricky phasing lines or adjustments would be necessary.

After a great deal of discussion with other hams, it was decided to add the two half-wave sections to the single V section and try it out on the air. The standard of comparison was the two-element yagi array described several times in *73* (see the May, 1980, issue). The yagi has a forward gain of about 5 dB and usually had a slight edge over the original V beam when working VKs and ZLs.

After adding the two half-wave sections, the signal from the V with the added pair of half-wave radiators was S8 while that from the yagi was S6. Subsequent tests with VK stations confirmed that the new array was indeed producing a signal in the South Pacific two S points stronger than that from the yagi.

It will be easier for the reader to follow if we describe the characteristics of each section of the ultimate array as we go. The V beam with which we started has two legs, each 91 feet, 4 inches long, as shown in Fig. 1. The correct apex angle for a V with two-wavelength legs is approximately 70°. The distance across the open end of the V is 104 feet, 9 inches. If we bisect the V as indicated by the dashed line in Fig. 1, we divide the triangle (V) into two parts.

The angle between this bisector line and one leg equals one half of the apex angle or 35°. The 35° angle is called the tilt angle and is important in the design of V, rhombic, and similar arrays. According to standard published data, a V beam with two wavelengths on each leg will have a bi-directional gain of about 4.5 dB over a dipole operating under the same conditions of height and power input.

The feedpoint at the apex of the V is high impedance and is normally fed with a quarter-wave "universal" stub or a tuned open-wire line. The tuned open-wire line used to feed the W6TYH V is a half wavelength (22 feet) long at 21.3 MHz. From the tuned coupler circuit, a 4:1 toroidal balun matches the 52-Ohm (RG-213/U) coaxial line to the transmitter. At the transmitter, a coaxial relay is used to permit instantaneous switching of either the comparison yagi or the V-curtain array to the transmitter and receiver.

The two in-phase, half-wave sections are stretched in a straight line, as shown in Fig. 1, and connected to the V apex feedpoint. These two

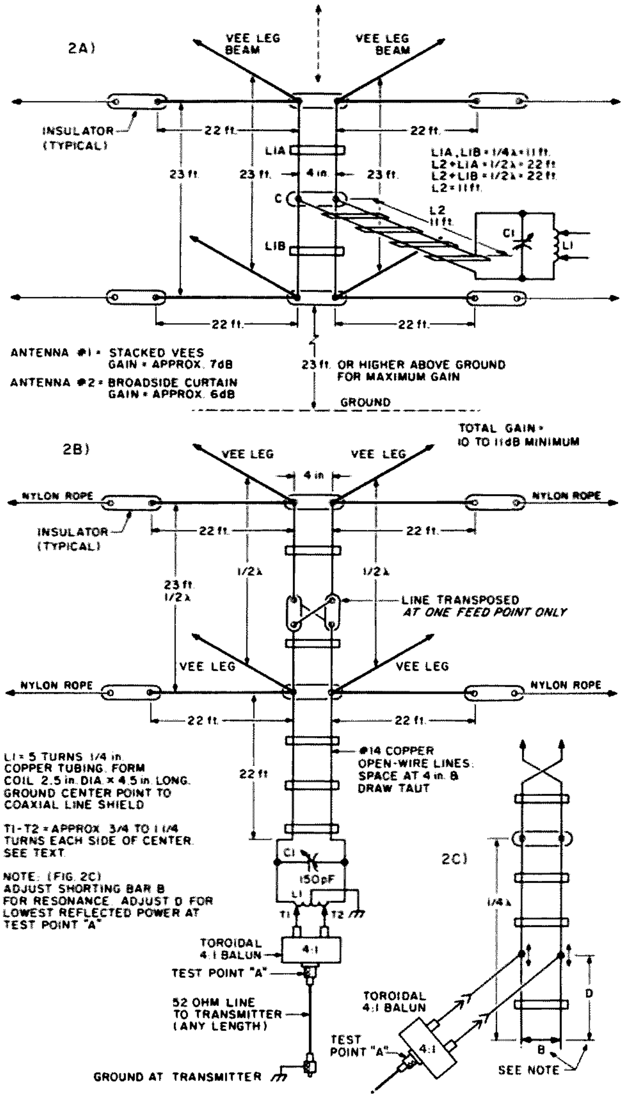


Fig. 2. Details of the stacked V beam with broadside curtain (lazy H). Both arrays operate in phase.

wing sections are each at an angle of 55° with respect to their adjacent legs and at 90° with respect to the V bisector line. Since two half-wave (180°) linear radiators operated in phase have a gain of about 2.8 dB over that of a dipole, we may add this gain to that of the V beam. Thus, the 4.5-dB gain of the V plus the 2.8 dB of the pair of half-wave radiators equals 7.3 dB. Just to be on the safe side, let's call it 6 dB. The effective DX gain will be greater than the calculated figures when additional sections are added to the V and the linear radiators.

When two V sections are stacked, without the broadside elements the bi-directional gain will be increased to about 7 dB in each direction along the bisector. The array normally is fed at test point A, as shown in Fig. 1. If one half of the phasing line (connected between the two apex feedpoints) plus the open-wire feedline are equal to one-half wavelength, as shown, a high impedance will appear at the end of the open-wire line. The parallel-resonant coupling circuit and the toroidal balun complete the transmission-line system between the array and the transmitter.

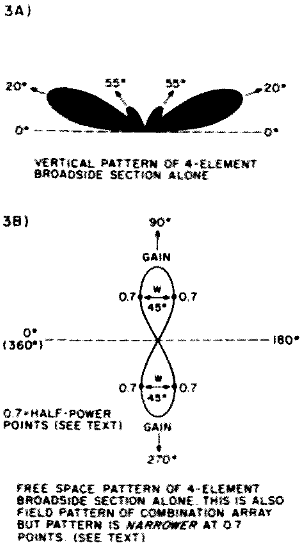


Fig. 3. Radiation patterns of multi-element phased arrays.

Now, if we add the four in-phase half-wave linear elements to the V system as shown at test point A in Fig. 1, we add about another 6 dB of bi-directional gain to the system. Since both the V and curtain sections are driven in phase with each other, their respective radiated fields add and produce a total bi-directional gain for the system of about 10 to 11 dB.

The exact gain over a dipole is dependent upon several factors, but you can be assured that this is a hot antenna system, both transmitting and receiving. Signals from the South Pacific that produce an S-meter reading of 3 or 4 with the yagi usually are past the S9 point when using the V-curtain array. Because the stacked broadside curtain section tends to lower the vertical radiation angle of the system pattern, the effective DX gain of the system is greater than the total of the section gains.

Alternative feed and phasing arrangements are shown at B and C in Fig. 2. In the arrangement at B, the stacking spacing must be equal to a half wavelength (free space), and the connections to one feedpoint and the phasing line must be reversed as shown. The open-wire line between the feedpoint and the coupling circuit must be a multiple of a half wavelength long. The open-wire line may be connected to the feedpoint of either the upper or lower V sections.

Combination Array Adjustments

The combination array, if built to the specifications given here, is virtually foolproof and will give a good performance with the dimensions shown in Figs. 1 and 2. However, to handhone the array for maximum field intensity, proceed as follows.

Resonating and matching: The feedpoints of the array proper and at the coupler end of the open-wire line are points of high impedance (rf voltage). The coupler consists of a 150-pF variable capacitor connected across a copper-tubing coil. The coil consists of 5 turns of 1/4-inch copper tubing wound 2-1/2 inches in diameter and spaced to an overall length of about 4-1/2 inches. The center point of the coil is grounded to the metal case of the toroidal balun and the coaxial-line outer conductor (shield). The balun output terminals are tapped about 1 to 1-1/4 turns each side of the coil center tap. The balun taps are moved closer to or away from the coil center as required during the adjustments.

With the balun connected to the coil, set C1 at about half maximum capacitance. Connect an swr or reflected-power meter in series with the balun input terminal, place the selector switch on forward (F) and turn the instrument sensitivity control completely off.

At the transmitter end of the 52-Ohm (RG-213/U or RG-8/U) coaxial line, apply about 5 Watts of rf power of the correct frequency. For 15 meters, the array normally will be adjusted for 21.3 MHz. Turn up the swr-meter sensitivity control until the indicator reads exactly full scale.

Now, throw the swr-meter selector switch to reflected (R) and quickly rotate C1 for the "dip" or lowest indicator reading. If the indicator does not go all the way down to zero, move the balun output connections further away from or closer to the coil center point and readjust C1.

When properly adjusted, the rf power may be increased to full operating value (say 100 Watts) and the indicator will remain on zero. If the indicator rises as the power is increased, try trimming an inch or so at a time from the open-wire-line conductor length and readjust as above.

Another good test is to check the loading at the transmitter. When the coupler is properly adjusted and the 52-Ohm line matched through the balun to the tuned circuit, the transmitter should load to the proper dc milliamperes without the use of antenna tuners and similar devices. If the transmitter output-stage dc-current value is too low, try moving the balun output terminal connections further away from the center of the coil.

The placement of these tap connections is critical. Move each tap connection about 1/8 turn, retune C1 for zero reflected power, and check the transmitter output circuit dc-current value. With the copper-tubing coil as specified, C1 will be at about half maximum capacitance (about 75 pF).

If the coil spacing is increased, the Q of the tuned circuit will increase and the loading characteristics at the transmitter are generally improved. However, when the antenna coupler circuit is high Q, the bandwidth will be reduced slightly. At W6TYH, the matching and loading adjustments are such that the array may be operated about 100 kHz each side of 21.3 MHz before any noticeable rise in the swr value occurs.

The coupler circuit, as described above, operated perfectly with the V array alone and with the one pair of half-wave linear radiators connected. With this arrangement, the open-wire transmission line was a half

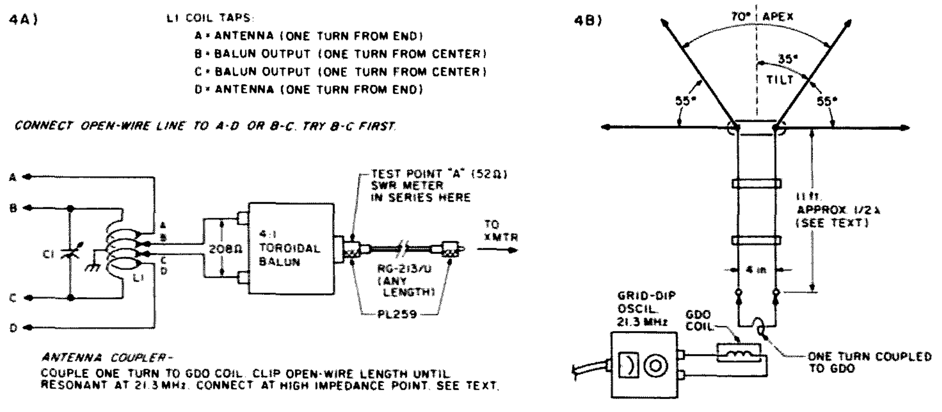


Fig. 4. Antenna coupler details. V-bomb antenna system.

wavelength (22 feet) long. However, when the stacked arrangement was completed, it was found that capacitor C1 would tune to a shallow dip on the reflected-power-meter indicator but a complete (0) null could not be obtained. The coupler circuit was then changed as shown at A in Fig. 4.

Coil L1, in this case, consists of 6 turns of No. 12 Teflon™-covered copper wire wound on a Bakelite™ coil form 2 inches in diameter and 3 inches long. The turns are evenly spaced over the length of the form. The balun output terminal connections are soldered to the copper conductor exactly 1 turn each side of the coil center point.

Tuning capacitor C1 is connected across the entire coil winding, as shown. The open-wire transmission line in our case is connected to taps A and D. The A and D taps are made exactly 1 turn from the ends of the coil. See Fig. 4 at A. The open-wire-line taps are correct for a balanced line of approximately 500 to 600 Ohms.

If you want to be "scientific" and hand-hone the array to resonance, connect a 1-turn coil across the open-wire line, as shown at B in Fig. 4, about 11 feet, 4 inches down the line from the point where the line is connected to the V apex feedpoint. Cut both wires of the line, leaving the line one-quarter wavelength from the apex feedpoint to the 1-turn coil.

Lightly couple the 1-turn "link" coil to the coil of a grid-dip oscillator. Set the grid-dip oscillator on 21.3 MHz and monitor the gdo frequency with a calibrated receiver. The 1-turn coil should be connected to the open-wire line with a pair of copper alligator clips so that it may be slid up or down the line.

As you slide the link coil clips up and down the line, you should find a point where a sharp dip occurs on the gdo indicator. This is the point at which the antenna system is resonant. Always check the gdo frequency with the calibrated receiver when resonance is indicated because the adjustments tend to pull the oscillator off its own calibrated frequency indication.

Next, cut off the unused ends of the quarter-wave line section. Now take the quarter-wave line section that was removed and cut its length to exactly the same as that of the pruned quarter-wave section still attached to the array. The two line sections are now soldered together to form a half-wave line. Attach the coupler circuit and adjust for zero reflected power at test point A, as before. I have found this method to be very accurate in adjusting open-wire lines to exactly one-quarter or one-half electrical wavelength.

On-the-Air Tests

You must remember that the spread of the bi-directional pattern from this array is much narrower than that of a conventional 3- or 4-element rotary beam. This array is most useful for working into a specific area such as Europe or the South Pacific. At W6TYH, we are interested in keeping in touch with friends in Tasmania and New Zealand. The stacked combination V and broadside arrays illuminate all of Australia and New Zealand.

With this orientation, it lays down terrific signal levels across the Great Lakes region of the USA and southeastern Canada. However, because of unstable propagation conditions, only a few European stations have been worked. Once, when working a station in Cleveland, Ohio, the initial contact was made with the 2-element yagi. The signal report was Q5 S6 using the yagi. Then the V-bomb array was switched to the transmitter with the same dc input power. The signal report was S9 + 20 dB.

Using the Super Antenna

Most hams dream of having an antenna with a gain of 10 to 11 dB. A rotary beam (yagi) antenna with gains in this order for the HF bands would be a very expensive device. It is possible to build very high gain fixed-wire antennas for a fraction of the cost of a multi-element rotary beam and the necessary supporting tower.

An antenna system with extremely high gain always has a very narrow, highly concentrated field pattern. In general, antennas with more than 10 dB gain, particularly those of the rhombic type, can cause problems because of the small illumination area both in the ionosphere and at the receiving location. It is common practice in commercial point-to-point communication to build up antenna gain only to a specified level and then "fill in" with high power.

Watch the signal-level meter on a sensitive shortwave receiver tuned to a high-power shortwave broadcast station such as Radio Moscow, BBC, Radio Australia, or the VOA. Note that the signal, as evidenced by the indicator pointer swing, is constantly fading up and down, but the audio level remains fairly constant. These stations are designed with a compromise between high erp and power input to the final stages of the transmitter.

If you live near a VOA station, pay it a visit. These stations are open to public visitation during business hours. However, you should call the station manager and arrange for an appointment. Usually, if a group of three or four hams visits a VOA station, they will arrange a guided tour of the facilities conducted by one of the engineers.■

Brew a Coffee Ground Plane

No cream, no sugar—just a 440 antenna that really percolates.

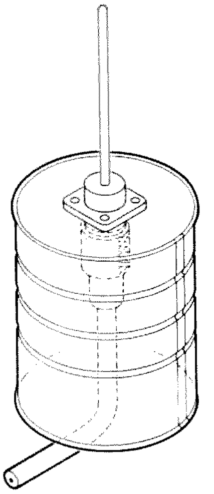


Fig. 1. The coffee ground-plane antenna.

Hank Goldman WA2OVC
2530 Independence Avenue
Riverdale NY 10463

This project was awarded third prize in 73's Home-Brew III Contest.

Here is a great UHF antenna project for the readers of *73* that costs much less than the $73 Home-Brew III limit. In fact, if you pay more than $0.73 for the parts, you haven't been to a good ham flea market lately!

This isn't a "toy" project either, because as luck would have it, certain household items resonate on the ham-band frequencies. Specifically, a 1-lb. metal coffee can is a perfect ground sleeve for the base of a "non-gain" very omnidirectional 440-MHz antenna.

The can will be a "freebie" from your kitchen and all you need to buy new (if you don't already have one in the junk box) is a coaxial chassis female connector.

Step 1: Drill a hole in the bottom of the can to mount the connector, which is installed with the threaded part *inside* the can.

Step 2: Cut a 9" piece of stiff wire or rod and solder it vertically into the connector on *top* of the can.

Step 3: Attach your RG-8 from the radio to the connector *inside* the can. With low power at first, key the rig and measure swr or maximum power out while you trim 1/8" sections off the rod till the antenna resonates in your favorite part of the band.

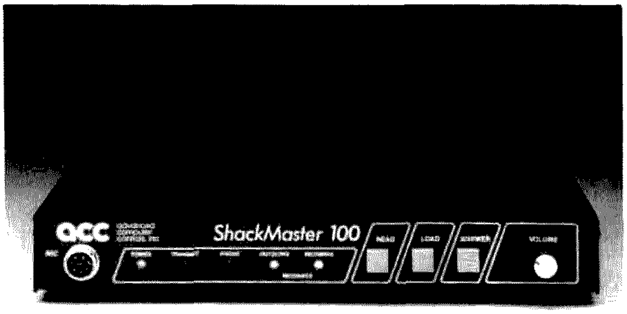
Step 4: Once it's resonated, spray everything with silicone and lash it to a mast, or high on your tower.

Step 5: Start having fun. ■

Takin' It to the Streets—Part I

Work the world from your HT! Crossbanding expert WA6AXX explores the how-to of remote and auxiliary operation.

Ed Ingber WA6AXX
Advanced Computer Controls, Inc.
10816 Northridge Square
Cupertino CA 95014



The ShackMaster 100.

Grabbing the Control Window

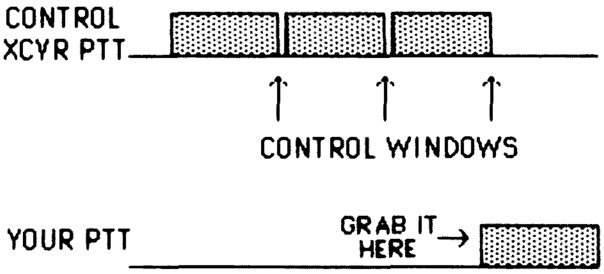


Fig. 1.

Hi, Frank. Look at what I just got.

Hi, Tom. Looks like one of those tiny new hand-helds.

Right. But it's really my new HF rig.

A hand-held HF rig? That means you can carry it around?

You bet. It's an allband SSB rig that puts out a hundred Watts.

A tiny hand-held HF rig putting out that kind of power? Come on, now! I'll bet the batteries last only a few seconds!

No, I get about eight or ten hours of operation from 'em. And see the rubber ducky antenna?

Yea...

It does as well as my four-element tribander on my sixty-foot tower at home.

A conversation from the year 2000? Not at all—Tom's ordinary UHF hand-held is linked to his home HF station, which lets him operate his high-frequency equipment from anywhere.

A New Way of Life

Operating today's HF equipment is very similar to the old days of VHF. Without hand-helds or repeaters, getting on two meters meant that you needed a base transceiver with a good outside antenna or a high-power mobile rig. Then, in time, hams discovered that repeaters could retransmit signals to extend their range. Newer technology made hand-helds possible, and when combined with repeaters, hams could carry their "2-meter shack" in their hand. Amateur radio became more fun and the ham's way of life changed!

Not much has changed about operating HF, however. Today's transceivers are certainly easier and much more fun to use than those of the old days, but you still need to be at home in the shack, sitting in front of the rig, in order to operate. The only alternative is a second rig installed in the car, with funny-looking antennas and compromised performance. Even then, the mobile rig is available only when you're in the car. Considering the investment in a modern HF station (rig, linear, tower, antennas, rotor, coax, etc.), and considering that the station is available only a small percentage of the time, there must be a better way—and there is!

That better way involves having your hand-held (or mobile) VHF or UHF transceiver crossband linked to your HF station. As with a repeater, your VHF transmissions are retransmitted by your HF station, and HF signals received at home are retransmitted on VHF back to you.

Did I hear you say that repeaters aren't legal on HF? Right, but this isn't repeater operation—it's remote control of another amateur station (your home station from your hand-held) and is called auxiliary operation.

Crossbanding

What do you need to operate crossband? At home, you need your HF transceiver, of course, plus a VHF or UHF control transceiver to allow you to communicate with your home station. Then you carry around another VHF or UHF transceiver with you, such as a hand-held.

Your hand-held and the control transceiver at home form the control link, which is the key to remotely controlling an amateur station. (The station also can be remotely controlled by wire line, as we'll see later.)

The Station Controller

If another ham were at home to push the buttons and turn the knobs, it would be easy. Just wire speaker audio to the mike and you'd be done. But truly practical crossband operation should let you completely control your home station directly from your remote control point. We need something to act as a station controller, something to tie the equipment together and to let you remotely control it.

Thanks to the evolution of control-system technology developed for modern amateur repeaters and to a new generation of externally-controllable broadband HF transceivers, such a station controller is now available—it is the ShackMaster™ 100 by Advanced Computer Controls.

Since your hand-held is already capable of encoding touchtones™, we'll use touchtone signaling as an easy way to command your home station. The controller needs to listen to the control transceiver and decode and interpret your touchtone commands. The commands that you enter are similar to the keyboard sequences that let you load frequency memories into your HT and let you make it scan. The difference is that you transmit the sequences as touchtones; it is similar to activating a repeater autopatch.

Communication between the operator and the station controller needs to be two-way, however. What frequency are you currently on? Did you enter the command you thought you did? Where is the antenna pointed? Since you don't have a TV camera at your station which would let you look around at how everything is set, you can use the electronic speech synthesizer in ShackMaster to acknowledge and respond to your commands.

The controller must also handle all the audio switching and mixing, control the transmitter push-to-talks, provide VOX detection, allow for convenient local use of the equipment, and display the status of the system.

Operating Simplex

A problem becomes obvious very quickly. With one VHF transceiver, you can't listen and transmit at the same time. Your single control transceiver at home can't, either. When the control transceiver is retransmitting HF activity, it needs to check periodically to see if you want to enter a command or to make a transmission through the HF rig. It does this through a "control window"—a brief interruption in the transmission from the control transceiver which allows the ShackMaster controller to listen for you to break in. (See Fig. 1.)

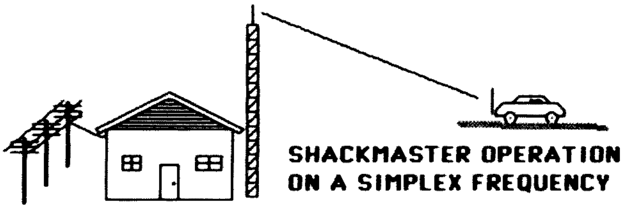


Fig. 2.

If you do break in and grab the window, you keep it and can then change frequency or enter other commands, retransmit yourself through the HF rig, etc. If you don't grab the control window, there's simply a brief "hole" in the transmission from your home station. A short beep just before the window lets you know exactly when to key down to grab it. When you want to grab the window, just wait for the beep and then key down.

The duration of the control window should be as short as possible to minimize lost information, and may be limited only by the switching time of the control transceiver (time to go from transmit to receive and detect a signal at the receiver). Practical window durations range from around 10 ms to 300 ms, depending on the rig. The frequency of the control window is a matter of personal preference, but a window every three or four seconds is about right to ensure positive control of your home station.

Window timing is fully programmable and can be changed while you're operating. For normal operation, you might want the window every few seconds, but for casual listening to a net you can extend the window to occur every ten or twenty seconds or so.

Operating Full Duplex

Simplex operation is great for casual work since you need to carry around only one rig. For higher performance operation, such as chasing DX, two control transceivers (preferably on different bands!) let you transmit commands to your home station while continuously listening. This is full duplex operation. The control window is eliminated and you can tune around and rotate the beam faster, without the need to synchronize to the control window. Full duplex operation is one step closer to actually being in the shack.

Operating Through a Repeater

A good VHF "control" base station can have a range of many miles, obviously depending on local topography, antenna height, and power levels. Range can be optimized to a particular area—for example, along your commute path to work—with a VHF beam. Inevitably, however, you'll want to access your home station when you're out of direct range. Enter the repeater.

Operation through a repeater is similar to operating simplex. Both your hand-held and your control transceiver at home are tuned to the same repeater. The only trick is that the repeater probably has a hang time; the repeater transmitter stays on for a period of time after the input signal goes away. When the station controller interrupts its transmission (the control window) to listen for you, it sees the repeater carrier still present. This would fool the controller into thinking that you've grabbed the window.

The solution is to indicate to the controller that you're activating functions through a repeater. Then it knows not

to look for a carrier during the control window but to listen for audio instead, using its internal VOX detector. When operating through a repeater, to grab the control window simply key down and talk or send a touchtone command. The controller's VOX detector senses your presence and lets you keep the window.

Some diplomacy should be used when operating crossband through a repeater, of course. Get the permission of the repeater owner first, and be sure that your command codes won't accidentally activate control functions of the repeater itself. It's also good to be sure that other users of the repeater don't object to the sounds of HF operation on the machine. In many areas, there are lots of fine, open 220- and 440-MHz repeaters which are begging for users. Occasional crossband activity through these repeaters is an excellent use of the resources available.

Accessing the Home Station by Telephone

There may be times when you're even out of repeater range of your home station or when you simply would like the privacy of remotely operating your home equipment from the phone. ShackMaster connects to your home phone line and lets you call home to perform all the functions by phone that you can command over the air. Again, touchtone commands via phone control the HF transceiver and rotor, but also allow you to access either of the two control transceivers as well. That means that you can get on your local repeater when you're out of town by calling home. Or operate the HF station from work, from a friend's house, or even from a phone booth!

Controlling the HF Rig

You want your "pocket HF station" to duplicate as closely as possible actually sitting in front of the rig. To do this, you need the ability to control HF frequency and mode. You also would like to be able to scan, recall the rig's memories, and so on. These functions are all activated with simple touchtone sequences. Commands are provided for direct frequency entry, scanning up or down at three rates, bumping frequency up or down in 20-, 100-, or 500-Hz increments, selecting mode, and recalling transceiver memories. Commands are generally acknowledged with synthesized speech responses.

Rotating the Beam

A simple dipole antenna works great on 40 and 80, but for the higher frequency bands, the chances are that you've got a beam. While you could operate from your remote control point with the beam stuck in one direction, since you want your pocket station to be just like sitting in the shack, the ability to rotate the beam is important.

A rotor-control board is designed to mount inside the Hy-Gain/Telex rotor control box (for the CD-45-II, Ham IV, etc.). The board provides an interface from ShackMaster to the control box, allowing you to remotely rotate clockwise or counterclockwise, specify a direction, or read back the current direction in synthesized speech with simple touchtone commands.

Turning the Station On and Off

Naturally, you want to be able to turn your equipment on when you're using it and back off when you're done. (The control transceiver should stay on all the time, though, so it can hear your commands.) Several forms of general-purpose remote controls are useful. Touchtone-commandable logic outputs can switch relays, turn things on and off, etc. For control of ac-line-operated equipment, an interface to the BSR home-control system provides a simple, clean, safe capability to turn station equipment on and off. Even 115-volt coaxial relays can be controlled for antenna switching.

Controlling the Control Transceiver

We saw earlier that your home station can be accessed on a simplex frequency, on a pair of frequencies for full duplex operation, or through a repeater. But what if you're operating on a simplex frequency and you're driving out of direct range? Or if someone else needs to use the repeater you're working through? You can command your control transceiver, your link from home, to QSY! Two frequency memories inside ShackMaster make it easy to QSY between two favorite frequencies, or any frequency may be entered directly with touchtone commands. If you make a mistake or the new frequency is busy and ShackMaster doesn't hear from you after you tell it to QSY, it'll come back to where you were originally!

Housekeeping

The control transceivers must be IDed periodically, and this function is performed in synthesized speech by ShackMaster. A variety of "control operator"-level touchtone commands allow enabling and disabling various functions remotely. Timers protect against "failure of the control link," such as from driving out of range.

What Rigs to Use?

If you're willing to leave the HF rig on a single frequency, virtually any HF transceiver can be used, but clearly the fun is in the ability to tune around and change modes. That means that the rig must have provisions for external control. The ideal ham transceiver would have a serial computer port on the back which would allow all of its front-panel functions to be activated from the port. While this ideal rig doesn't yet exist, the trend is in the right direction and several available HF rigs have computer ports. They include the ICOM IC-751, Yaesu FT-757GX, Yaesu FT-980, and others. Several older ICOM rigs include limited provisions for external computer control as well.

These modern rigs are solid state and broadbanded and require no tune-up, unlike those of the old days when it was necessary to "dip the finals." Some equipment, such as ICOM's transceiver, linear, and antenna tuner automatically work together without the

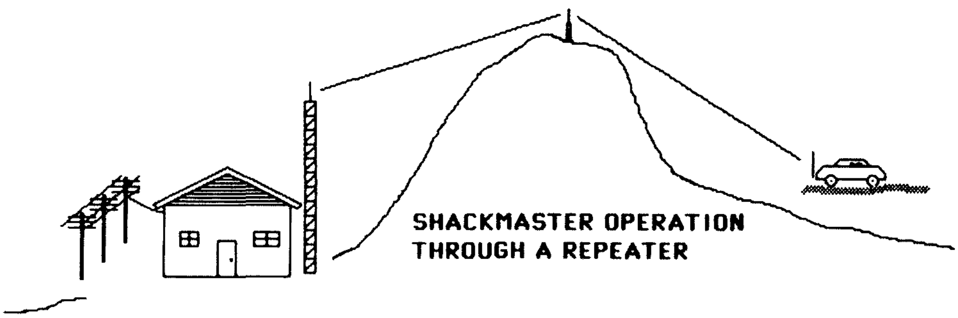


Fig. 3.

need for controlling them separately. With today's equipment, an unattended HF station is as practical as unattended repeaters.

Frequency control of the VHF/UHF control transceivers is less important but can also be useful, particularly for telephone access and for the ability to QSY. Any synthesized, BCD-controlled rig such as one which uses thumbwheel switches is easy to control by electrically simulating the thumbwheels externally. These rigs include many older ones that may right now be sitting on your shelf—the ICOM IC-22U, IC-2/3/4A, Kenwood TR-7400, Azden PCS-3000, etc. ShackMaster's frequency-control-board option can wire directly to many of these rigs. Newer rigs such as the ICOM IC-271 and IC-471 have computer ports for external control.

The Rules

The rules allow an amateur-radio station to be operated by remote control. Transmissions for controlling and intercommunicating with the station are considered manual, locally-controlled, auxiliary operation, and are currently limited to frequencies above 220.5 MHz. (The QCWA has filed a Petition for Rulemaking with the FCC proposing elimination of this restriction on auxiliary operation.) This means that the control transceiver should operate on 220, 440, or 1200 MHz.

Your home HF station is operated under manual remote control, and there are no restrictions on its frequency of operation. Telephone access to your home station is considered wireline remote control.

Operation of your home station by remote control requires some simple procedures, outlined in §97.88, such as posting a photocopy of the station license, a list of control operators, etc. A functional block diagram of the control link and a system-network diagram should be included as part of the station log. Relevant sections of Part 97 rules include §97.3, §97.61(d), §97.88, §97.90, and §97.126.

A New Way Is Here

The ability to carry your HF station with you anywhere changes the character of HF operation. Your expensive home station is available to you 99% of the time instead of only 1% of the time. Even around the house you don't have to be cubbyholed in the shack; you can be with the family or working in the garage or the yard. Meet your skeds, check into nets, and generally rag-chew and work DX from anywhere.

Crossband operation eliminates the need for a second HF rig for mobile operation and thus its expense and vulnerability to theft. And by crossbanding you can take your HF station with you when you leave the car! Of course, you can still put your base rig in the car when you go on long trips.

Apartment and condo dwellers can install an HF station at another location and then use it from home. Radio clubs can get the most out of their club station by allowing members to operate it from their homes. Emergency service groups can have hand-held access to HF to supplement their VHF communications during emergencies.

And most of all, operating an HF station which fits in your hand and clips onto your belt is FUN!

In part two of this article, I'll discuss other useful capabilities of the ShackMaster. ■

Ed Ingber WA6AXX is the President of Advanced Computer Controls, Inc., of Cupertino, California.

Mike Tarnowski WD9ELC
2927 A East Bottsford Avenue
Saint Francis WI 53207

Build the Broadband Bow Tie

It's every ham's dream: An 80m antenna with a flat swr of 1.5:1 from 3.5 to 4.0 MHz. And it couldn't be simpler.

Are you content with being stuck in one narrow segment of the 80-meter band? Do you enjoy tuning your transmatch so your solid-state rig will function properly? If you answered no to either of these questions, you may be interested in this antenna. It works well across the entire band. The swr is better than 1.5:1 from 3.5 to 4 MHz.

The Broadband Bow Tie was built as a Field-Day antenna for Ham Radio Explorer Post 373 (see Fig. 1). In the past we've tried normal dipoles, verticals, and even a double extended zepp. None of these were reliable or broad enough; we decided to try something new. It had to be reliable. It had to be simple to erect and dismantle. It had to be cheap. And most important, it had to cover the entire band without the help of a transmatch.

Library books and old magazines produced two interesting antennas. One was a fan dipole. The other one was called a 10-meter Wonder Bar (Figs. 2 and 3). Both looked good, but neither was quite what I wanted. So I combined the best features of each, and the result is the 80-meter Broadband Bow Tie.

Begin building by finding the parts (see Parts List). Other than the toroid core, all parts can be found at either Radio Shack or your local hardware store.

You will need to start with the two sections of ¾" thinwall conduit. Flatten each end of the conduit for 2 inches or so and drill a ⅜" hole 1 inch from each end. Make a loop in one end of each wire and solder it securely. Put a 5/16" screw through the hole in the conduit, slide on the wire, put on the other hardware, and tighten (see Fig. 4). For permanent installations, each connection should be taped.

Connect the wires to the center insulator as shown in Fig. 5. Each wire is 62′ 4″ long from the end of the conduit to the center insulator. Temporarily solder a SO-239 connector to the antenna and hook up some 50-Ohm coax. You're ready to set it up and do some preliminary testing.

Set up the Bow Tie at the location you plan to use it. Hook up your transmitter and swr bridge. On-the-air testing should be done in the morning or afternoon to avoid QRM.

Keeping keydown time to

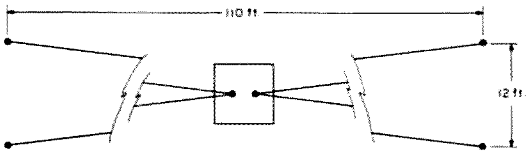


Fig. 2. 80-meter fan dipole.

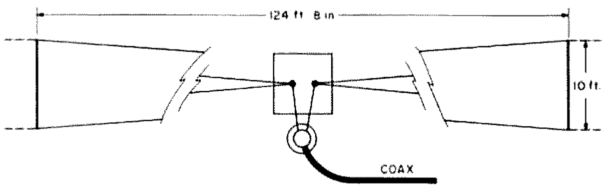


Fig. 1. 80-meter Bow Tie antenna. The 10-foot conduit spreaders can be mounted either vertically (as shown) or horizontally.

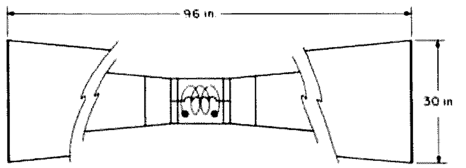


Fig. 3. 10-meter Wonder Bar.

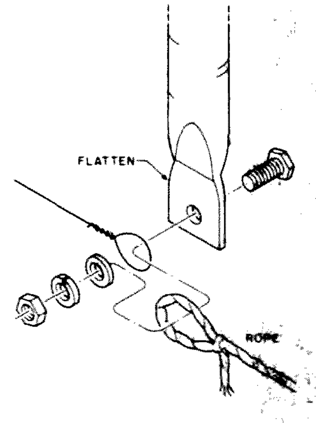


Fig. 4. Detail sketch of spreader, wire, hardware, and rope.

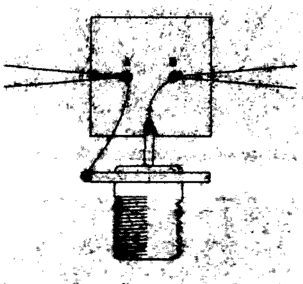


Fig. 5. Detail of center insulator before un-un is attached. SO-239 is removed and put on un-un.

a minimum, check the swr across the band. I checked it every 50 kHz and graphed the results (see Fig. 6). I found that it was flat at 3:1 from 3.5–4 MHz. This could be due to its low height (20′ at one end and 6′ at the other). It could be that it was too long or it could be simply a characteristic of a large-diameter dipole. The important thing is that it does not change appreciably across the band.

The next step is to wind a transformer to match the 17 Ohms of my antenna to the standard 50-Ohm coax.

My transformer was wound on a junk-box toroid of unknown origin (Fig. 7). Any toroid core that can handle a kW at 80 meters should work. There are 12 turns of #14 enameled wire on the feedline side. There are also 12 turns on the antenna winding, but with a tap at each turn. The correct turns ratio is equal to the square root of the swr, so in my case $\sqrt{3}$ = 1.73:1 at 7 turns on the antenna side. A tapped secondary is used because height above ground may greatly affect the impedance.

Once the un-un (unbalanced-to-unbalanced transformer) is wound, take down the antenna and remove the SO-239. Solder in the un-un and raise the antenna. You should be ready to operate on 80 and 75 meters.

This antenna was built and erected temporarily in the early afternoon. There was not a lot of activity on 80 or 75 meters at the time. We were able to work any station that we could hear with a barefoot TS-520S. Signal reports varied from S7 to 10 over S9 both ways. Performance seems to be about the same as you get from a dipole. The difference is in the bandwidth. I have never seen a dipole that can cover the entire band the way the Broadband Bow Tie can. I'm pleased with this antenna, and if you try it I think you will be too.

I would like to thank KA9DHM, KC9ON, KA9MBR, and the others in Explorer Post 373 for their help and encouragement.

Afterword

This antenna was taken to Field Day. It was used on CW and SSB. Stations were worked from coast to coast. It was set up 20 feet high between two trees. The swr was even better than Fig. 6 curve B. I sincerely believe that it was worth the effort. ■

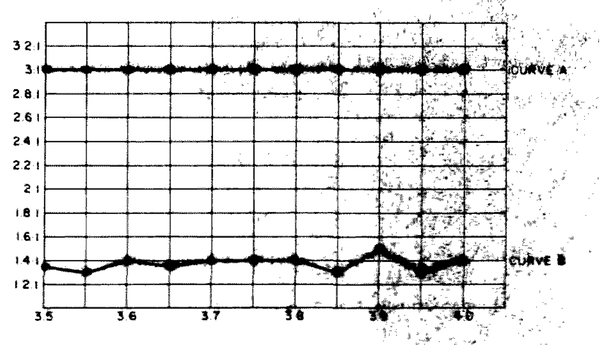


Fig. 6. Swr curves: Curve A is measured without un-un transformer. Curve B is with un-un tapped at 7 turns (1.7:1 turns ratio, 3:1 impedance ratio).

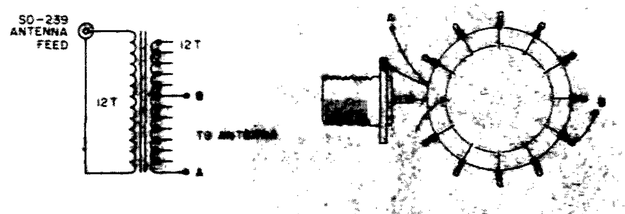


Fig. 7. Un-un matching transformer. Each side has 12 turns. Secondary is tapped every turn.

Parts List

4	rolls antenna wire, 65 ft. each, Radio Shack #278-1328
1	center insulator, Radio Shack #270-1518
2	pcs. ¾" thinwall conduit, (EMT), 10 ft. each
4	screws 5/16-18 x 1.5 inches long
8	5/16" flat washers
8	5/16" lock washers
4	5/16-18 hex nuts
1	SO-239 coax connector
1	toroid core, 2-inch or larger

References

1. Stu Leland W1JEC, "The Old Timers' Notebook: Remember the Wonder Bar Antenna—A 10-Meter Bow Tie?" *QST*, April, 1968, pp. 58–60.
2. William I. Orr W6SAI, "A Broadband Dipole System," *Radio Handbook*, 19th Edition, 1972, pp. 25.9, 25.10, 25.11.

Stan Gibilisco W1GV
PO Box 144524
Coral Gables FL 33114

Don't Fall for Swr Fraud

Your feedline may be swindling you. Find out how much power you are losing and how to stop it.

Most every ham owns an swr meter. This instrument is indispensable for determining antenna resonances and impedance matches. But swr meters indicate the antenna-feedpoint swr only when they are connected at the antenna end of a transmission line. If it is important for you to know the actual degree of mismatch between your antenna and feedline, you must either connect the meter at the antenna feedpoint or incorporate a correction factor into the measurement. It's not very convenient to read a meter while suspended in midair or hanging atop a tower while a brick sits nonchalantly on the key of your 50% duty-cycle transmitter! But fortunately, such contortions are not necessary. There is an easier way to accurately determine the feedpoint swr.

What Is Swr?

There are several ways to define standing-wave ratio (swr), and the definition we choose actually affects the value. The way we generally see swr defined is something like this: If the antenna impedance is a pure resistance (R) and the characteristic impedance of the feedline is Z_0, then the swr is either R/Z_0 or Z_0/R, whichever is greater than or equal to 1. That's very nice, but rarely is the impedance of a real-life antenna a pure resistance. There almost always is some reactance present as well, and this completely ruins the above definition. The constraints are hardly ever met.

Another popular definition of swr is the following: The voltage along a transmission line occurs in "loops" (maxima) and "nodes" (minima). The voltage standing-wave ratio (vswr) is simply the ratio of the voltage at a loop to the voltage at a node: E_{max}/E_{min}. Sounds good! But what if the feedline is very short? Loops and nodes occur at intervals of ¼ wavelength along a transmission line. If the line is shorter than ¼ wavelength, then there is no swr according to this definition. If the line is long, there will be numerous voltage loops and nodes along its length, but because of line loss, no two maxima or minima will be the same. How then can we determine swr?

A third method of defining swr is whatever an swr meter indicates. This definition is quite convenient and makes precise determination possible (assuming the instrument is correctly calibrated and is not affected by external factors). So why not make it easy on ourselves? In real life, how else are we going to determine the swr, anyway?

Effect of Line Loss

Regardless of the kind of feedline you use, it will have some signal loss. Even the largest hardline is not perfect. The loss in any transmission line increases with the operating frequency. Fig. 1 shows the loss in dB per foot as a function of frequency for the most common coaxial lines used by amateurs. The values in Fig. 1 are based on the assumption that the feedline has not become damaged or contaminated (some of the outer jacket eventually gets into the dielectric material of certain cables). These loss figures also are accurate only if the swr is 1—that is, if the line is perfectly terminated. However, this information will help you to discover your feedpoint swr rather easily. To find the matched-line loss for your system, simply multiply the value from Fig. 1 by the length of your line in feet.

Of course, it is rare for the swr to be 1. There is nothing sacred about this theoretical ideal. No electromagnetic angels descend when the swr meter needle dips all the way to the left. Many hams have gotten the idea that even the most miniscule departure from a flat line is a horrible gremlin to be avoided at all costs. Actually, though, an swr as high as 2 will never cause appreciable loss compared to a perfectly matched system; even a val-

ue of 3 or 4 is often tolerable. In the old days of radio (and sometimes even today), open-wire feedlines were operated with standing-wave ratios in excess of 10 without detrimental effects. Still, it is a good thing to keep track of your swr since it may indicate aging of your feedline or other changes in the antenna system.

Suppose you measure your swr at the antenna feedpoint and find that it is 3. Now imagine that someone invents a sliding swr meter that can easily be moved along coaxial cable. As you move the meter away from the antenna and closer to your rig, you will observe a gradual, continuous decrease in the swr. Depending on the amount of matched-line loss, the meter may read anything between 1 and 3 by the time it reaches the station end of the cable.

The reason for this is simple: As the signal (electromagnetic field) travels down the line toward the antenna, the field intensity decreases because of losses in the line. Hence the "forward" reading of an swr meter is greater near the transmitter than at points far away along the line. If the antenna is not perfectly matched to the line, some of the field gets reflected at the feedpoint and starts back toward the station. This field, too, is affected by line loss, so the "reverse" indication on your swr meter gets smaller nearer the rig. More "forward" and less "reverse" signal near the transmitter: That's a lower swr.

Fig. 2 illustrates how the line loss under perfectly matched conditions (as determined from Fig. 1) affects the swr difference between the station and antenna ends of the feedline. The difference may be large. Your transmitter sees a certain swr at its end of the line and behaves accordingly; as such, you may have an swr greater than the transmitter can tolerate at the antenna feedpoint but still get away with it because line loss reduces the swr at the station to an acceptable value for the transmitter output circuits.

This difference between feedpoint and station swr may come to you as an unwelcome surprise: Your swr may be much higher than you thought! Perhaps you were laboring under the illusion that it was 1.7 all this time, and now you find out that it's really 4, and perhaps even higher (if your coaxial cable is very old). The good news is that the loss caused by swr is nowhere near as great as most people think. But certainly something is out of adjustment if you have an swr of 4 with a beam or quad.

A severe mismatch with a parasitic array could mean that you are not getting the forward gain or front-to-back ratio that you deserve. Perhaps there is corrosion at the feedpoint and line losses have been hiding this fact from you. A large change in swr at the feedpoint may cause a much smaller change in the swr at the transmitter.

Now, Really . . .

The actual swr on your feedline—the antenna feedpoint swr—depends only on the characteristics of the antenna and feedline as long as we employ the definition of swr based on empirical observation. Otherwise, swr is just about meaningless. The only practical way to measure it on a coaxial line is by using an swr indicator or impedance bridge. And it changes depending upon the location of the instrument on the line.

We need to be concerned only with the swr at the station and the swr at the antenna feedpoint. When putting up an antenna, it is a good idea to make swr graphs of both values for future reference. You don't have to climb to the antenna feedpoint to get the reading there; just use Figs. 1 and 2. Later, if the swr at the transmitter changes, you can use these graphs again to find out how *much* the swr at the feedpoint has changed.

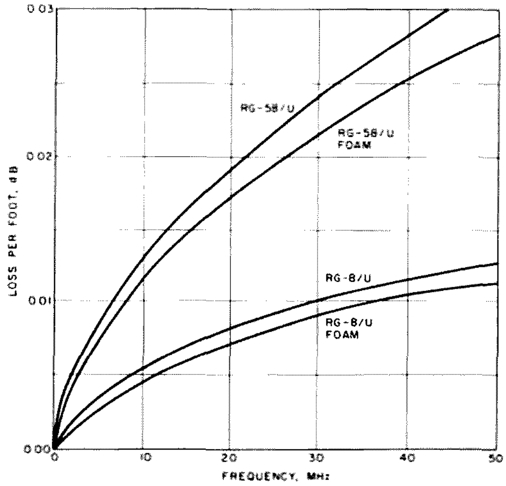


Fig. 1. Loss as a function of frequency for common 50-Ohm coaxial cables. Foam-dielectric cables have lower loss but may age more rapidly. These figures are in dB per foot; to find the overall line loss, multiply by the line length in feet. The result is the loss in your transmission line, assuming a perfect match.

The first two definitions of swr that were mentioned and then thrown out are useful for one purpose, at least, and are therefore worth remembering. There is a good chance you will be asked about *them on your* General, Advanced, or Extra class license test! ■

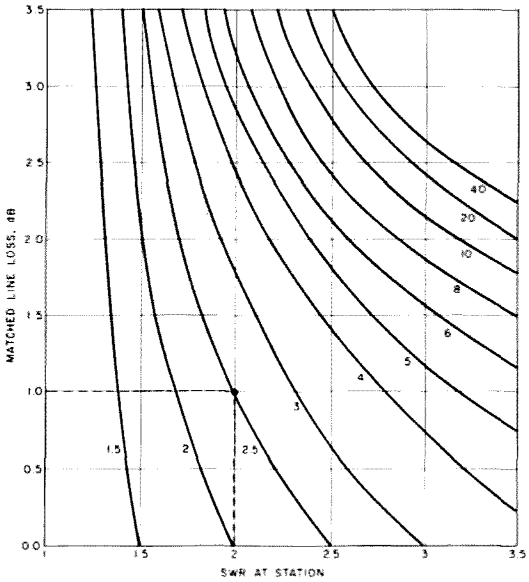


Fig. 2. Difference between station swr and feedpoint swr. Find the station swr on the horizontal scale and the perfectly-matched line loss in dB on the vertical scale. The antenna feedpoint swr may then be interpolated from the curves. In the example shown, the station swr is 2, the line loss under perfectly-matched conditions is 1 dB, and the antenna feedpoint swr is 2.5.

Robert Gooch, Jr. N3DRW
2975 Mallview Road
Baltimore MD 21230

Whip the Competition

Improve your 2m HT's "mileage" with this custom antenna from Datsun!

After the smoke had cleared from my workbench, I realized that my secondhand HW-202 could not tolerate any more repairs. After many years of service, the old Heath was ready for retirement. Then came the task of searching through stacks of ham magazines to locate a 2-meter rig which suited my budget.

I decided on an HT for practical reasons. One phone call brought the new rig to my front door 3 days later. The ICOM 2AT worked like a dream until I tried to raise my club repeater from my work QTH—the distance was too great to even trip the COR. I then took a serious look at the 30-day return policy. But instead, 3 days later I was the proud owner of a larger battery pack and higher expectations. Even with that, the return policy still looked appealing.

Giving my "toy" one last chance, I took a long look at the rubber duck. Now face it, every ham knows the secret to a good signal, and that's a better antenna! Roughly one hour later I was working the club repeater on low power, at full quieting, without any changes to the rig or batteries. How? Exit the rubber duck, enter the "Datsun."

Since I work at an auto radio shop, finding the right antenna posed no problem. I decided on a custom antenna for a Datsun Stanza (part #FMF-75D by Harada Industries of America, Inc.). This fender antenna is all fiberglass with a stranded copper-wire center conductor. A clean cut at 19 inches from the top ball was the quarter wave I needed. (I would highly suggest using a grinding wheel if possible, as the 'glass will splinter easily if cut with a saw or snips.)

I used a BNC connector for the 2AT, but with some ingenuity, other connectors can probably be used. The BNC is an Amphenol type, #31-4700, for RG-58/U. At the cut end of the whip, scrape 6 mm of 'glass away from the conductor, being very careful not to cut the copper wire inside. Next, trim down the circumference of the rod 14 mm past the 6-mm mark, so when the rod is pushed into the BNC sleeve it fits snugly up to the end of the 14-mm mark.

Tin and trim the center wire at 4 mm. Place the BNC center pin on and solder it in place. Don't use too much solder. Next, carefully push the assembled antenna into the connector until the pin is flush with the white insulator at the base of the plug. The 'glass whip should now be snug in the sleeve. All that's needed now (and highly recommended) is 2 or 3 layers of increasingly longer shrink tubing for support about 3 inches up the shaft from the BNC.

Although I have not used any complex antenna formulas in this design, it's still a quarter-wave antenna, and the body of the HT makes up the ground plane. I have used this new antenna for quite some time now and am amazed at the range I can get out of my rig.

I am willing to offer a kit version of this antenna if there is sufficient interest. Send an SASE to the address at the beginning of the article if you might be interested. ■

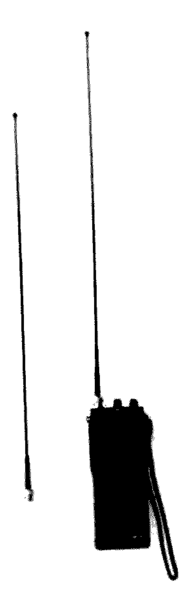


Photo A. N3DRW's custom 2-meter quarter-wave whip.

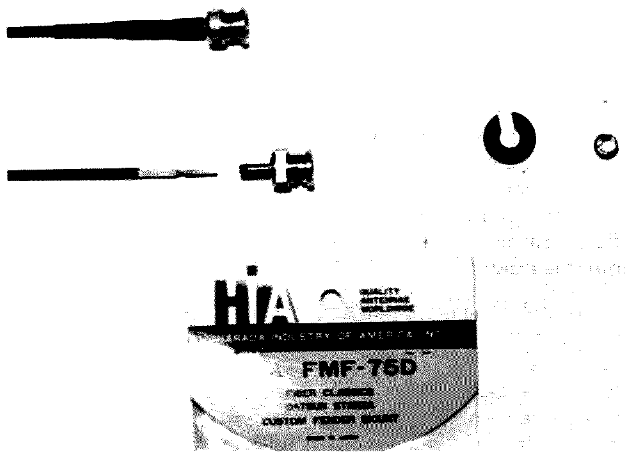


Photo B. Construction detail.

Harry D. Hooton W6TYH
1420 Shamrock Lane
Lincoln CA 95648

Exponential Potential

The problem: A broadband antenna fed with coax exhibits narrowband response. The solution: Use this exponential-line matching system.

In high-power shortwave broadcast stations such as the VOA and others, the tapered or *exponential* line is generally used to match the high feedpoint impedance of a single-wire rhombic antenna to a lower-impedance main transmission line or transmitter rf output terminal. As an example, the feedpoint impedance of a rhombic designed for operation at *any* frequency between 4 and 21 MHz might have an input impedance of about 850 Ohms at 4 MHz, 700 Ohms at 14 MHz, and 625 Ohms at 21 MHz.

When the exponential two-wire line is used in conjunction with a lower-impedance main transmission line, the characteristics of the wide-frequency-band antenna are not restricted by transmission-line limitations. Although few hams are likely to realize the dream of owning the ultimate in directional arrays, the exponential line matching section does have other interesting applications, es-

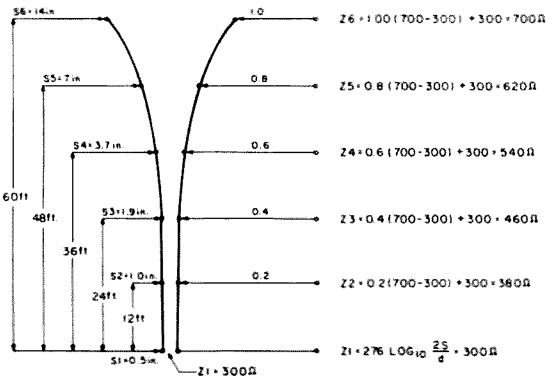


Fig. 1. Exponential line matching system for W6TYH's wideband 75-meter antenna system, using #12 copper-wire conductor (diameter = 0.08081"). S = conductor spacing in inches, center to center.

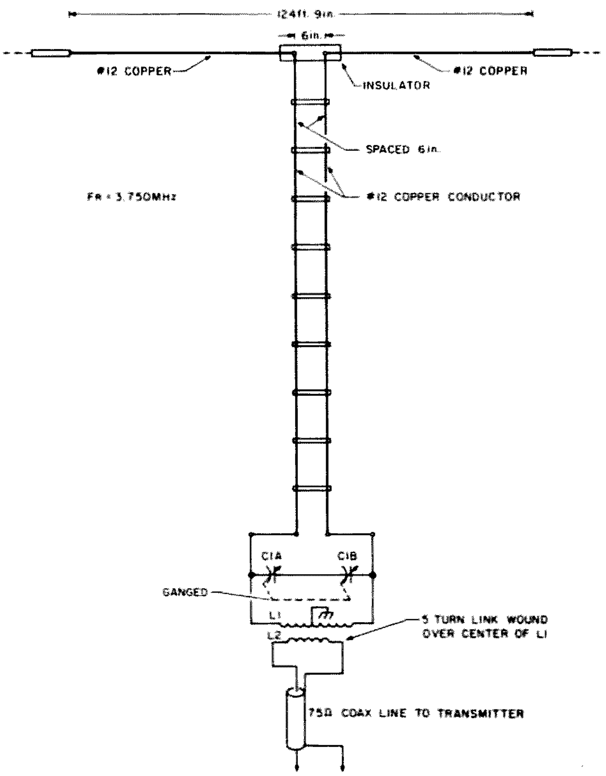


Fig. 2. The original 75-meter dipole at W6TYH (see text).

pecially for shortwave receiving antennas and for VHF and UHF arrays.

As shown in Fig. 1, the spacing between the two line conductors is greatest at the end of the section connected to the antenna. At this point, the impedance of the line is high enough to closely match the impedance of the antenna feedpoint for maximum transfer of rf energy. The other end of the line, in the direction of the transmitter, has very close spacing between the two conductors. If the line is properly designed and constructed, the low-impedance end of the tapered line may be easily matched, for ham purposes, to a standard 300-Ohm TV "ribbon" line or to a 75-Ohm coaxial line through a 4:1 ratio toroidal impedance transformer, as shown.

To design and construct an exponential line matching section, proceed as follows:

1) The length of the line should be approximately a quarter wavelength long at the lowest frequency at which the array will be operated. For an amateur-radio antenna system designed for the lowest operating frequency of 4 MHz (75 meters), the length will be 60 feet. In the following discussion, we will assume a line 60 feet long to be constructed from #12 copper wire (diameter 0.08081").

2) Divide the 60-foot length into five smaller distances of twelve feet each. Since the impedance of the line varies linearly, the impedance at each 12-foot point can be determined with a reasonable degree of accuracy. Assume that the highest impedance point (the antenna end of the line) is to be 700 Ohms and the lowest impedance point (the transmitter end of the line) is to be 300 Ohms. The line is to be exponentially "tapered" between the spacings required for the two impedance values.

3) Now, determine the impedance value at the 12-, 24-, 36-, 48-, and 60-foot points up the line. At 12 feet, the impedance is 12/60 or 0.2 of the difference between the two end impedances *plus the impedance at the low-impedance end of the line*. Thus, at 12 feet, for example, $Z_2 = 0.2(700 - 300) + 300 = 380$ Ohms. Likewise, at 24 feet the impedance is 24/60 or 0.4 of the difference between the two end impedances plus the impedance at the low-impedance end of the line. Numerically, $Z_3 = 0.4(700 - 300) + 300 = 460$ Ohms. At 36 feet, $Z_4 = 0.6(700 - 300) + 300 = 540$ Ohms. At 48 feet, $Z_5 = 0.8(700 - 300) + 300 = 620$ Ohms. At the top end, $Z_6 = 1.0(700 - 300) + 300 = 700$ Ohms. Z_1, at the bottom end, equals $276 \log_{10} 2S/d$, where S is the center-to-center spacing between the two conductors and d is the diameter of one conductor. Both S and d must be expressed in the same basic units.

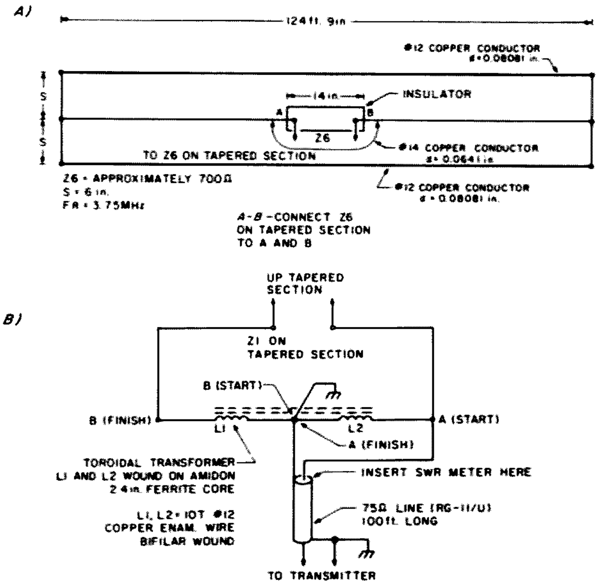


Fig. 3. (a) A triple-conductor system for 75 meters. (b) Method of coupling exponential line to a transmitter.

4) To determine the center-to-center spacing, S, between the two conductors at the various points along the line, use the following formula: $S = (d \times \text{antilog}_{10} (Z_0/276))/2$, where Z_0 is the impedance at the point on the line (above), d is the diameter of one conductor, and S is the center-to-center spacing between the two conductors expressed in the same basic units as d.

As an example, for the 700-Ohm impedance point (top), using #12 copper wire with a diameter of 0.08081 inches, $S = (0.08081 \times \text{antilog}_{10} (700/276))/2 = 13.9 = 14$ inches.

Wideband 75-Meter Antenna System

At W6TYH, we used a half-wave, centerfed dipole, cut to 3.75 MHz for many years. This single-wire

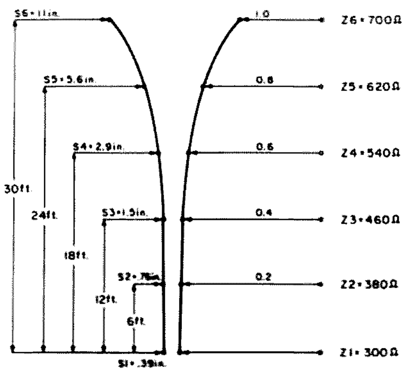


Fig. 4. Exponential line matching system for a wideband 40-meter antenna system, using #14 copper-wire conductor (diameter = 0.064"). S = conductor spacing in inches, center to center.

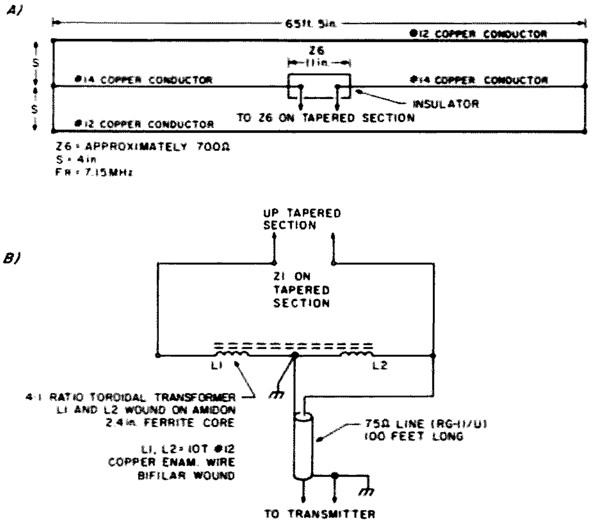


Fig. 5. (a) A triple-conductor system for 40 meters. (b) Method of coupling exponential line to a transmitter.

antenna was fed by a tuned feeder system made from two #12 copper wires 60 feet long spaced 6 inches apart. At the source end of the open-wire line, the system used a parallel-resonant circuit coupled to a 52-Ohm coaxial line by means of a 5-turn link coil. Although this antenna system performed well when tuned to the operating frequency, the bandwidth was relatively narrow. In order to operate on frequencies near the band edges (3.5 and 4.0 MHz), it was necessary to retune the coupling circuit, which meant opening the 52-Ohm line to check the line swr.

Since the tuning circuit was located some distance from the ham shack, this necessary adjustment was a great inconvenience to say the least. Also, in spite of the fact that the tuning unit was placed in a "waterproof" enclosure, during wet weather moisture collected on the plates of the variable air-dielectric capacitor, causing the circuit to detune, resulting in an excessively high swr on the coaxial transmission line. As a result, the system could not be used during rainy weather. The original dipole antenna system is shown in Fig. 2.

The antenna system shown in Fig. 3 was used to replace the single-wire dipole arrangement. Here, the radiator consists of a half-wave, centerfed dipole, but the radiator consists of three conductors in a folded-dipole arrangement. The first dipole that was installed used three #12 copper-wire conductors. The calculated impedance at the center of the middle wire was 675 Ohms, which is a close match to the 700 Ohms at the upper end of the exponential line section. With this arrangement, the swr on the 75-Ohm coaxial-cable line measured about 1.75:1. The center conductor was replaced with #14 copper wire and the coaxial-line swr was reduced to about 1.2:1 and remained close to this value at all frequencies between 3.5 and 4.0 MHz. The system is not affected by wet weather and the coaxial-line swr is the same no matter what the weather, wet or dry.

For 40 meters and the other bands, the tapered matching section is designed in the same manner as previously described. For 40 meters, the length of the tapered section should be about 30 feet. For 20 meters, the length will be about 15 feet. The three-wire dipole should be cut for the band center frequency using the formula 468/f, where f is the frequency in MHz. ■

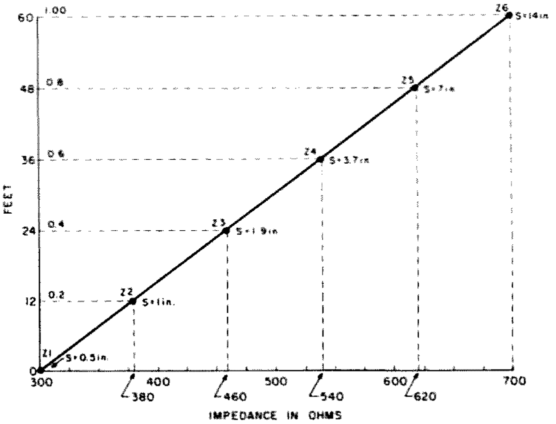


Fig. 6. Graph of impedance versus length for the 75-meter exponential section. Note that the curve is linear.

William Vissers K4KI
1245 S. Orlando Avenue
Cocoa Beach FL 32931

Wheatstones Are Not Crackers!

Here's the slickest application of the Wheatstone circuit yet devised. The Nuller Bridge is the only instrument you'll need to adjust your antenna matching unit to peak performance.

My first exposure to and fright over a Wheatstone bridge was in high school physics class more than fifty years ago. The many knobs, an ultra-sensitive string galvanometer, formulas, and multiplying factors that would choke a horse (combined with the dire warning from the instructor, *"Don't peg the meter!"*) kept me turned away from bridges for years.

Later experiences were different. I learned that a simply-designed, accurate rf bridge circuit can easily be built from readily-available parts and that it will allow you to tune up your matching unit properly without radiating any appreciable power while at the same time keeping your transmitter swr at 1:1. In addition, a provision can be made to first tune up your transmitter into your dummy load without radiating any rf power at all and also to monitor your relative power output. And lastly, when you are all tuned up, with a flip of a switch your transmitter can be connected directly into your tuner/antenna system, and again your meter monitors relative power output.

All of this can be accomplished with my "Nuller Bridge" without ever once thinking of actual values of swr or perhaps worrying about what it means!

Good accuracy for the bridge circuit is easily accomplished. First, 47-Ohm, ½-Watt, 5% carbon resistances are readily available, so if we built a bridge using them we would have a good 47-Ohm bridge. However, as almost all of our present-day equipment is based upon a 50-Ohm impedance value, we will design for that figure.

It would be possible to file down the 47-Ohm resistors to 50 Ohms, but there is a much easier way. In the theoretical bridge circuit of Fig. 1, if we shunt one of the 47-Ohm resistances (RD) with a resistance (RE) of 736 Ohms, we find that the equivalent parallel resistance (RB) would be equal to 44.18 Ohms. (RB = 47 × 736/(47 + 736) = 44.18.) And now, using the basic bridge equation, where RX is the unknown resistance, RX = (RA × RC)/RB = (47 × 47)/44.18 = 50 Ohms.

Well, since I did not have a 736-Ohm resistor available, I just picked out a standard 680-Ohm, ½-Watt, 5% carbon resistor out of my

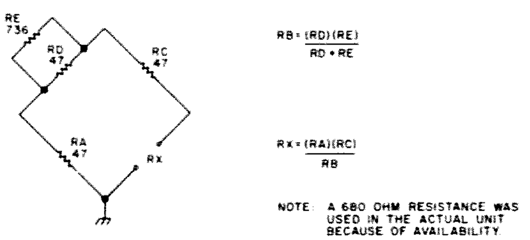


Fig. 1. A theoretical 50-Ohm bridge.

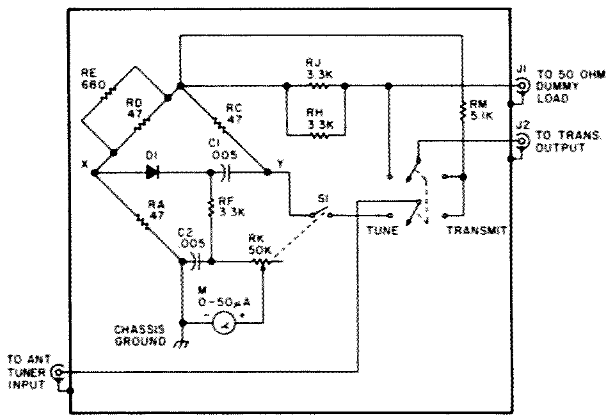


Fig. 2. Schematic of a more practical circuit.

stock and found that then RB would be 43.96 Ohms. Substituting into the basic bridge equation, we find that RX = (47) (47)/43.96 = 50.25 Ohms. This value was so close to the original design value of 50 Ohms as to be indistinguishable in any tests I could make.

Another reason why this basic bridge circuit is accurate is that it contains no inductors or capacitors and hence is frequency-insensitive. If you look at the diagram of a conventional inline swr meter, you will see its complexity; my own experience of trying to build one to the accuracy I wanted proved quite frustrating. In comparison, the simplicity, ease of construction, and accuracy of the Nuller Bridge were a pleasant surprise, particularly as it does so much more for you than an swr meter does in tuning up your rig.

Let me emphasize that because this unit is not an swr meter, it requires no swr scale or elaborate calibration procedure. And if we think a bit more, we realize that when we tune up our transmitter through our antenna tuner, we are really interested only in obtaining an impedance match. Since the Nuller provides an accurate impedance match, why worry about swr? And as the feature of the Nuller is to allow the tuner to tune up for an impedance match without allowing your transmitter swr to be more than 1:1, then there is absolutely no reason to be concerned in any way with swr.

So with this simple unit we have finally laid to rest the bogey of swr tune-up problems. It would have been possible, with extra circuitry, switching circuits, and calibration techniques, to make the scale read swr, but as it would only complicate its operation and provide no functional purpose, why not entirely break the hold that swr seems to have had on so many of us?

The circuit is shown in Fig. 2. It was designed for use with my Yaesu FT-101B with a key-down power output of about 100 Watts. Because the circuit is so extremely simple, it can be readily modified for use at higher powers by using higher values of resistance for the voltage-dropping resistances feeding the bridge circuit.

Operation of the unit is best explained by referring to the diagram shown. First, place switch S2 in the tune position. RK is an ordinary linear 50k variable resistor with a switch, S1, that opens when the knob is fully counterclockwise, just like the volume control on most radio and TV sets. In the counterclockwise position, all 50k Ohms of resistance are in the metering circuit.

As switch S1 is now open, the input of our antenna tuner is disconnected from the bridge circuit.

Also, with switch S2 in the tune position, the dummy load is connected directly to the transmitter. The voltage from the dummy load is applied to the bridge circuit through the dropping resistances, RJ and RH, which are connected in parallel.

The bridge is now unbalanced because S1 is open, and the microammeter will show the voltage developed across bridge points X-Y after it is rectified by the diode, D1. So now the meter shows an output that is a function of the power in the dummy load.

This feature is an advantage, as even though you could watch for your plate-current dip and adjust your transmitter power-output control, you now also have an rf monitor right at the dummy load, and during this stage of transmitter tune-up your antenna tuner is disconnected and you do not radiate any power out. Naturally, as your transmitter is connected only to your dummy load, your swr at the transmitter is 1:1.

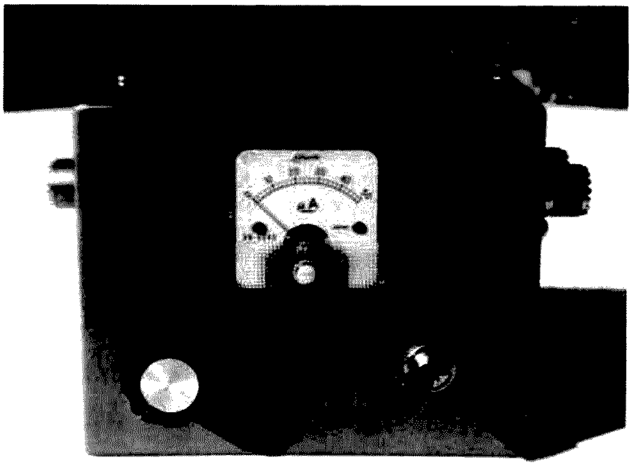


Photo A. *The finished Nuller Bridge.*

Now, if you turn the control knob of RK in the clockwise direction, switch S1 closes, the antenna tuner is now connected to the bridge circuit, and RK becomes the sensitivity control for the meter-nulling circuit. Now all you have to do is adjust your tuning unit until your meter reads zero, and your matching antenna system is tuned up to fifty Ohms. During this tune-up process, switch S2 is still in the tune position so that your transmitter is still loaded into the dummy load; the swr at the transmitter is still 1:1. And now if switch S2 is switched to the transmit position, the transmitter is connected directly into the antenna tuner which is already properly adjusted, and you can go on the air.

My only precaution is the common-sense one: It is best to turn your transmitter-output control to minimum when switching S2 to avoid possible momentary transients. This is a general safety precaution in switching all rf circuits carrying appreciable power.

Now, with switch S2 in the transmit position, the voltage-dropping resistance, RM, provides voltage to the bridge, which is again unbalanced because the antenna-tuner input is no longer connected to point Y on the bridge. As before, the bridge voltage across points X-Y is rectified and fed through the diode to the meter and provides a power-output monitoring system; at this time, RK acts as a sensitivity control.

The two fixed capacitors, C1 and C2, and RF provide a filter circuit to electrically isolate the metering circuit from any rf from the bridge circuit. None of the values of any components is critical, and I just used what I had available.

The only special care I took when building the unit was to place jacks J1 and J2 on one side of the box and J3 at the other side, as shown. The components were just soldered to an ordinary strip connector and all grounds brought together at one point before grounding to the chassis. The three jacks were grounded only to the case, as the metal provided sufficient conductivity without any need for additional wire connections between them. Although I was fortunate in having picked up a small 50-microampere meter at a hamfest for fifty cents, any 50-microampere meter will operate satisfactorily. The unit worked exactly as planned with no problems encountered.

When I am through using my transmitter, I switch S2 back to the tune position and then turn RK counterclockwise so that switch S1 is open. This isolates the transmitter from the antenna-tuner system and is a nice precaution to avoid possible induced voltages from nearby electrical lightning discharges. (Florida leads the nation in electrical storms and every method of protection is desirable.) However, this method is in no way a substitute for your regular lightning protection methods.

Parts List

Chassis box, 4 × 5 × 3 inches*
D1—1N34A diode*
C1, C2—.005-uF capacitors
M—0-50 microammeter
RA, RC, RE—47-Ohm, ½-Watt, 5% carbon resistors*
RD—680-Ohm, ½-Watt, 5% carbon resistor*
RJ, RH—3.3k, 2-Watt, 10% carbon resistors
RM—5.1k, 2-Watt, 10% carbon resistor
RF—3.3k, ½-Watt, 10% carbon resistor
J1, J2, J3—SO-239 coax connectors*
RK—50k linear taper, variable resistor, 271-1716*
S1—Potentiometer switch for RK, 271-1740*
S2—6-Amp DPDT switch (Note: For higher powers, a heavy-duty, G. C. Electronics Co., catalog number 35-144, 10-Ampere DPDT switch can be used.)

* These parts available at Radio Shack. All other parts were readily available at local electronics stores.

In addition to ensuring that your transmitter tune-up swr is always 1:1, the unit has another major advantage. When using the ordinary method of tuning up, with your transmitter directly coupled through your matching unit to your antenna, it is easily possible to find combinations of settings on your matching unit that can either present series-resonant circuit conditions to your transmitter or, in other cases, produce impedances much higher than 50 Ohms. Either case can be dangerous to your expensive equipment. This unit eliminates that possibility.

Another feature is that when tuning up directly into your matching unit, there is interaction between your transmitter's output controls and the controls on your tuner that often make you wish you were an octopus. This unit also eliminates this interaction problem.

In my own case, just for fun, I borrowed a Bird wattmeter from a friend, calibrated the unit for power output vs. meter reading for the dummy-load position, drew a curve, and pasted it on the back of the unit for reference. There is no real need to do this, but it is a quick way to find out if your rig is putting out properly if trouble develops.

No decals were pasted on the unit. (At age 72, I find it hard to line up the letters and make them stick to the shiny grey enamel of the small chassis.) Besides, with only two controls, the operation becomes almost automatic after using it a few times.

The ease of construction of the unit lends itself to all amateurs, and its utility solves all of the vexing swr problems previously encountered. ■

References

"The Telematch," Byron Goodman and Walter Lange, *QST*, February, 1965.
"Tune Up Swiftly, Silently, and Safely," William Vissers, *QST*, December, 1979.

Stan Gibilisco W1GV
PO Box 144524
Coral Gables FL 33114

A New Angle for Dipoles

Stand them on end! Sounds odd, but W1GV presents an excellent case for HF vertical dipoles.

Vertical antennas have always fascinated me. Many people don't think they work well or have tried them and had marginal results. But the vertical is a temperamental antenna. It has to have what it needs in order to do its thing. A well-designed vertical with an excellent ground plane will provide DX performance comparable to much larger and more expensive systems installed in less optimal places.

Recently I got the opportunity to stay in a home on the ocean. A thought came to me: salt-water ground plane. Another thought: vertical needing no radial system. A third idea: vertical dipole, giving 3-dB gain at an almost horizontal angle of radiation over a huge pond of highly conductive ocean. How could it fail?

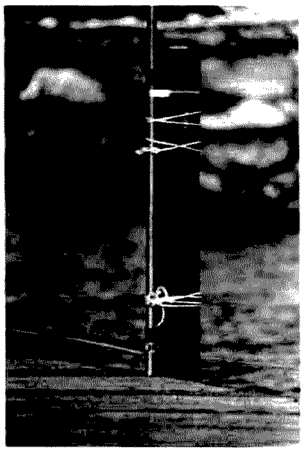


Photo A. The base mount used at W1GV/4 was crude but efficient.

Vertical Dipoles

Most hams think of a vertical antenna as a quarter-wave device, requiring a good ground system and radiating much of its energy in a horizontal plane. All three of these ideas can be challenged. You don't have to use a quarter-wave radiator, you do not necessarily need a good earth ground, and a vertical will not always have good low-angle radiation.

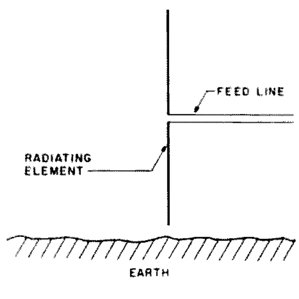


Fig. 1. Configuration of a centerfed, balanced, vertical dipole.

We all know the general radiation pattern of a half-wave dipole. Maximum radiation occurs perpendicular to the wire, and the least radiation is in line with the wire—assuming the antenna is straight. If a dipole is set up in an east-west direction, for example, the best radiation will occur in north-south directions (generally) and the least in the east and west directions. A lot of signal also goes up into space at high angles; quite a lot may even go straight up, and that doesn't do you any good at all. The same pattern holds for receiving.

For some reason, it doesn't often occur to people that they can turn the dipole sideways. Perhaps that is because the idea seems aesthetically inelegant: The feedline would have to come out from the center of such an antenna and be supported horizontally (Fig.1); it would look funny. Well, so what?

A half-wave vertical dipole is impractical for some hams to install because of its sheer height. At a frequency of f MHz, the height must be (in feet) 468/f, approximately, for half-wave operation. This is practical at frequencies above about 10 MHz for most of us; it is a challenge at 7 MHz, and almost an impossibility at 3.5 MHz. Don't even think about the idea at 1.8 MHz unless you live on a ranch and have connections with the FAA. I decided, therefore, to build the antenna for operation at frequencies above 10 MHz.

A dipole antenna can (and ideally should) be fed with a balanced, open-wire feedline. This is no less true for a vertical dipole than for a horizontal one. I decided to use parallel-wire line with this antenna, in conjunction with a matching network, to obtain multiband operation.

Dimensions

The physical dimensions of this antenna are shown in Fig. 2. The structure is slightly less than 20 feet high and has capacitance hats at both the top and the bottom. The capacitance hats effectively increase the

length, so that the antenna is resonant (as a half-wave radiator) near 14 MHz. The capacitance hats also reduce end effects and broaden the bandwidth at the resonant frequency.

The antenna is fed with TV-type ribbon line (the best I could find). The length is not critical, except, of course, it should be as short as possible to minimize loss. Certain lengths may result in difficulty "loading up" the system at some frequencies; this can be eliminated by adding or subtracting a few feet of line. This will be discussed in more detail later.

The radiator was placed about 4 to 6 feet (depending on tides) above the level of the water. Because of the vertical orientation of the radiator, there is more capacitance effect in the bottom half of the antenna than in the top half. This causes some unbalance, but I didn't worry about it. (It did not seem to harm the performance of the antenna.)

The line was run away from the antenna at a right angle—at least as near to a right angle as possible—all the way to the station. This is always advisable with any dipole antenna; it helps to maintain electrical balance. The line at W1GV/4 was about 60 feet long, but, of course, it is desirable to have the shortest line length possible to minimize loss.

Theory of Operation

The primary objectives in building this antenna were: (1) to obtain a low angle of radiation at frequencies from about 10 to 30 MHz, (2) to get relatively good efficiency, and (3) to have physical ruggedness and fairly small size. I think this antenna meets all these requirements very well. And it doesn't cost much to build.

The antenna works as a half-wave dipole around 14 MHz. At higher frequencies, the current loops move outward from the feedpoint, as shown in Fig. 3. At 28 MHz,

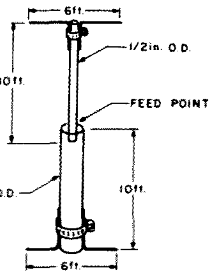


Fig. 2. The design used at W1GV/4 employed capacitance hats. The overall height was 20 feet minus 2 inches of overlap at the center.

the antenna is effectively a vertical, 2-element collinear. This produces a theoretical gain of 3 dB over the field strength at 14 MHz. The presence of the salt-water ground plane, nearly perfect, should result in about 2 dB more gain than would be had if the antenna were in a free space. One could expect that this antenna would perform spectacularly at 14, 21, and 28 MHz, and this expectation proved well founded.

You might wonder why I have paid no attention to swr. The reason is that parallel-wire line has very low loss, and even if the swr is quite high, this loss remains low. Ordinary TV ribbon line is less lossy, for a given swr, than the finest RG-8/U coaxial cable. I would imagine that the swr is around 5:1 on the line at 14 MHz; it is probably higher at 21 MHz and 28 MHz, but not much. I would have preferred to use open-wire (ladder) line for this antenna since it has even lower loss than TV ribbon, but in this particular isolated tropical paradise, such a rarity simply cannot be found.

One note: When using TV ribbon with a fairly high swr, you can't get away with high power. You would fry the line at current loops, and arcing would be very likely at voltage loops. A power output of about 150 Watts is the highest I would dare employ.

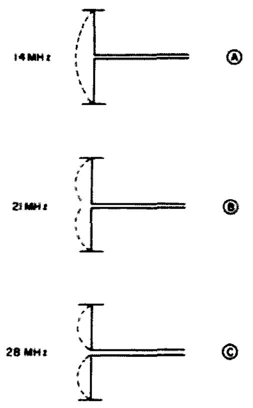


Fig. 3. Current distribution (theoretical) for the antenna at 14, 21, and 28 MHz. Some gain occurs at 21 and 28 MHz as a result of the dual current loops.

Construction

Aluminum tubing would be ideal for constructing this vertical dipole. I chose galvanized-steel electrical conduit for two reasons: (1) This area can be quite windy at times, and (2) none of the hardware stores nearby had any aluminum tubing. A complete parts list is given.

The bottom section of the antenna is identical to the top section except that 3/4-inch tubing is used on the bottom and 1/2-inch tubing is used on the top. The two sections do not telescope perfectly; there is some clearance. Wrap the lower 2 inches of the top section with plastic electrical tape until the sections telescope perfectly. Insert the top section 2 inches into the bottom section, and put more electrical tape just above the top of the bottom section to keep the top conduit from sliding down. This provides a mechanically strong center insulator (Fig. 4).

The top and bottom capacitance hats are made by first cutting each of the aluminum "slats" in half, giving four 3-foot sections. One end of each section is then bent at a right angle (Fig. 5). Hose clamps are used to attach the slats to the ends of the conduits (Fig. 6). The

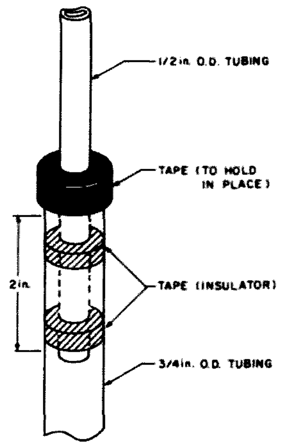


Fig. 4. Construction of the center (feedpoint) insulator.

completed antenna looks very much like a capital letter I—in fact, if you put it together right, exactly!

The parallel-wire line is attached to the feedpoint, or the center of the antenna, using hose clamps. It is a good idea to tin the ends of the feedline wires, especially if you live in a place where corrosion could be a problem (such as this QTH). It is best to wrap the contacts with tape before putting on the hose clamps. After the hose clamps have been secured over the insulated contacts, twine or electrical tape should be used to prevent undue strain on the wires at the feedpoint (Fig. 7). Plug the top of the antenna with the cork.

These procedures completed, the antenna is ready to be mounted. There are numerous ways of mounting a vertical antenna, and the particular method you use is up to you. I roped the base of the antenna to a wooden pole on the dock, using small wooden blocks as insulators (see Photo A). This is a rather sloppy way to do it, but I was more interested in DX than aesthetics. The main consideration is that the base of this antenna is not at a current loop but at a current node (voltage loop). This makes it essential that the base mounting have as little capacitance as possi-

Frequency Range	Overall Height	Overall Width of Capacitance Hat
28 MHz-54 MHz	10′	3′
14 MHz-29.7 MHz	20′	6′
10 MHz-21.45 MHz	30′	9′
7 MHz-14.35 MHz	40′	12′
3.5 MHz-7.3 MHz	80′	24′

Table 1. Dimensions for various frequency ranges. The ranges shown are for optimum operation; the antenna will perform reasonably well at frequencies somewhat outside the indicated limits.

ble so that the balance of the antenna will not be upset. At my QTH, the bottom of the antenna is about 4 to 6 feet above the salt-water ground plane—sufficient clearance to minimize imbalance that might be caused by capacitance between the ground plane and the bottom end of the antenna.

Having strung the feedline from the antenna to the station and having made sure that the line ran away from the antenna at a right angle for as great a distance as possible, the testing phase began.

Testing

To my dismay, the antenna failed at first to tune up on the fundamental band of 14 MHz. It tuned up fine on 21 and 28 MHz. It refused to accept power at 7 MHz, but to my astonishment, it was possible to get a very low swr at 3.5 MHz.

Open-wire lines, although relatively low in loss even when the swr is high, have a peculiar idiosyncrasy. The impedance at the station end of the line can vary tremendously depending on the length of the line. I would imagine that the feedpoint impedance of this antenna is about 60 Ohms at 14 MHz (lower than the theoretical 73 Ohms, owing to the capacitance hats).

The TV ribbon has a characteristic impedance of 300 Ohms. This means that the swr is 300:60, or 5:1. If the feedline were exactly 1/2 wavelength long, the impedance at the station end would be 60 Ohms, a manageable value. But it could range as high as 1,500 Ohms (300 x 5) or as low as 60 Ohms (300/5). Many transmatches will handle impedances of several hundred Ohms, but it is expecting quite a lot if you want one to match an impedance of 1,500 Ohms. I concluded that the line length was such, at 7 and 14 MHz, as to result in an impedance too high for my transmatch to deal with. This problem proved to be fairly simple to solve: All I had to do was cut the line length by a few feet. I did this by routing it through a different window. Adding a few feet of line would have worked just as well, but it is always desirable to minimize the line length to get the least amount of loss.

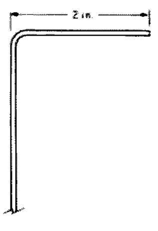


Fig. 5. The aluminum slats are bent at one end to facilitate attachment to the top and bottom of the antenna.

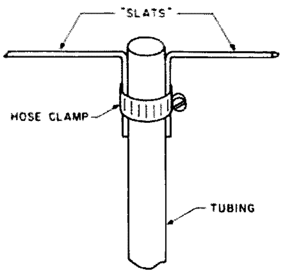


Fig. 6. Physical attachment of the slats.

Finally I got this antenna to tune up on all bands, 3.5 through 29.7 MHz. It was time to check it out. I chose 15 meters first.

I must confess to a certain fondness for QRP, especially when it comes to antenna testing. You don't test a new antenna with a kilowatt—even a battery of light bulbs will get some DX when using that much power. You don't use even 200 Watts output, nor 100 Watts, nor, in my opinion, 50 Watts. If you want to find out how well an antenna really works, you use very low power—something like 5 Watts. That is the output power I employed to test this antenna.

Caribbean DX came easily on 15 meters during the daytime. The ideal ground plane, a southeastern exposure, and the low angle of radiation worked together to give me 589 and 599 reports consistently on CW. Even from "stingy" stations which had no compunction about giving out 549 or 559 reports to their contacts (DX stations don't have to be generous), I got 589 and 599 reports—with five Watts.

On 20 meters, the situation was comparable.

On 40 meters, contacts were harder to make. I did not expect that this antenna would work very well on 40 meters since it was originally designed to work at 10 MHz and above. (I don't have 10-MHz capability yet, so I could not test this antenna

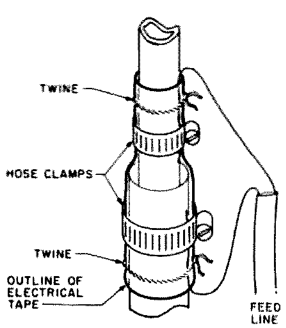


Fig. 7. The feedline is connected to the center of the antenna using hose clamps and electrical tape (see text for details).

at the 30-meter paradise.) I did have a few rag-chews amidst the heterodynes of the shortwave broadcast stations, but the reports were marginal.

Using this antenna at 3.5 MHz gave no surprises. The fact that it tuned up was evidently a coincidence, resulting from the line length and the length of the antenna elements. A few contacts were made, but with a 20-foot antenna and 5 Watts of output power, you wouldn't expect spectacular reports, and they weren't. All of the stations I contacted, moreover, were in the continental United States, opposite the salt-water exposure.

When I tried to test this antenna on 28 MHz—where it should have a theoretical gain of 5 to 6 dB—I had a problem. There was no one on the band. I checked the sun with a telescope and found a possible reason. Its yellow disk was as perfect as could be. Not a spot on it.

Conclusions

I began with the belief that there could be no reason why this antenna design should not work, at least at frequencies of 10 MHz and above. Test results have shown that the antenna does indeed work.

Larger versions of this antenna can, of course, be built. In the ideal case, the antenna height should be between 1/2 and 1 wavelength at the desired operating frequency. A height of less than 1/2 wavelength would result in reduced radiation resistance and, therefore, lower efficiency. A height of more than 1 wavelength would cause the angle of radiation to increase, and this would be detrimental to DX operation. This antenna, whatever its size, is therefore workable over only a 2-to-1 frequency range for optimum DX.

Capacitance hats are not really necessary with this an-

Parts List

1	10′ steel or aluminum conduit, 1/2″ o.d.
1	10′ steel or aluminum conduit, 3/4″ o.d.
2	Aluminum "slats," 6′ long by 3/8″ wide
4	1″ hose clamps
1	Roll electrical tape (plastic)
1	Base mounting apparatus (up to builder how to mount)
1	Cork for plugging the top
1	Length of parallel-wire line

tenna, but I have always believed in using them because they increase the bandwidth of any antenna. They also lessen the physical length necessary to get half-wave resonance on a given frequency. Some physical dimensions of this antenna, for various frequency ranges, are given roughly in Table 1. You might want to build an antenna similar to this one for operation at frequencies of 7 to 14 MHz, for example, or even 3.5 to 7 MHz if you happen to have the real estate.

Don't forget that while the optimal DX frequency range of this antenna is 2 to 1, it can function very well above the maximum frequency and below the minimum. A good radial system consisting of wires buried in the ground or run along the surface of the earth will enhance the performance (unless you happen to live on the shore of a large body of salt water, in which case radials aren't really needed at all).

I would recommend the use of open-wire ladder line and not TV ribbon, if you can find such line in your locale.

A good transmatch is an absolute necessity.

It is also helpful if you have neighbors who don't mind the looks of a bizarre antenna such as this one. Who knows—you might be communicating with hostile aliens from another galaxy. ■

K. C. Jones KA8RCJ
620 Meadow Drive
Newark OH 43055

Six for Two

Get range-tested 12-dB gain for under $5! K.C. Jones engineered this 2m delta beam for maximum bang per buck.

Here it is, just what the world needs, another article on two-meter antennas. It has been so long since STS-9 touched down that one would think enough has been said about the construction of two-meter antennas for working the shuttle. Well, I wanted to get my two cents in before I consider the case closed.

I had quite a lot of fun building this antenna and I learned a little in the process. One of the things I learned was that in ham radio it is not necessary to buy when you can build—and the learning experience is great. I will show you the somewhat unusual way I built this antenna while spending very little money.

My need for a two-meter antenna with gain and directivity came about in the same way it did for many others . . . the scheduled launch of STS-9 was drawing nigh. Since money is always tight in our household, my only options were to build an antenna or forget the idea of working the shuttle entirely.

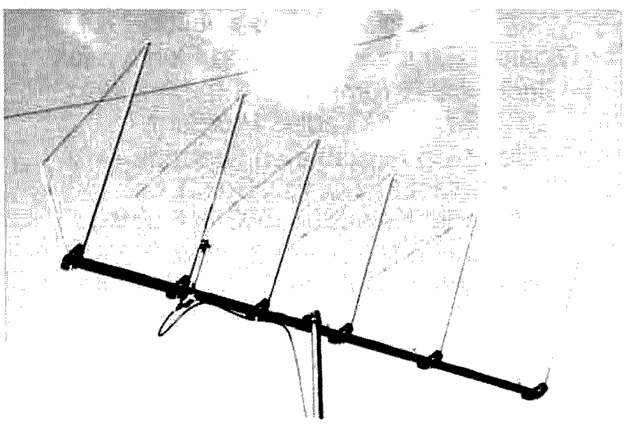
Nearly all of the ham publications at the time contained an article about building an antenna for working the shuttle. The most popular seemed to be some form of a turnstile antenna, which didn't suit my needs. I thought that if I were going to spend my time building an antenna, I would like to be able to use it for some other purpose besides the shuttle.

Remembering an old TV antenna in the attic and finding an old 1970 *ARRL Antenna Book* brought about interesting possibilities. I had visions of some sort of beam antenna built entirely of salvaged parts from the TV antenna. A simple yagi would do the job, or maybe a quad for both vertical and horizontal polarization. But for some reason, the three-element delta-loop configuration in the book caught my eye.

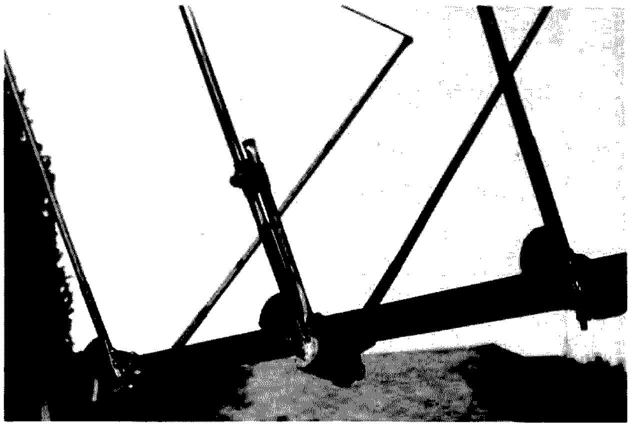
Configuration

At first I thought the three-element delta loop would be the antenna that I would build; however, I soon realized that five or six elements would be possible with the amount of aluminum that could be salvaged from the TV antenna. The first step I took was to come up with a design on paper.

A graph in chapter four ("Multi-Element Arrays") of the *Antenna Book* showed that the length of the boom of a five-element yagi should be just under one wavelength and a six-element should be just over one wavelength. The TV antenna had enough aluminum to make seven or eight elements on my antenna, but its boom was close to one wavelength long so I de-



The six-element delta-loop antenna for 146 MHz.



The gamma match. There is a variable capacitor enclosed in the film can.

cided on building the delta loop with six elements.

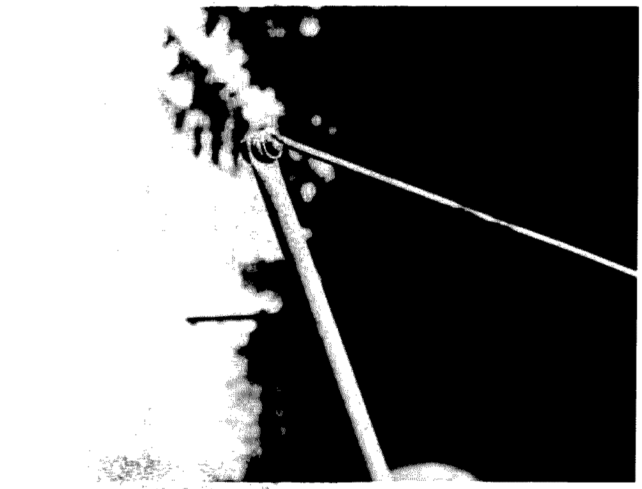
Now that I knew I would use six elements, finding the size of each element was the next bridge to cross. The *Antenna Book* showed the distance around the driven element to be 82 inches. This was arrived at by using the formula, length in feet = 1000/f (where f is the frequency in MHz) found in the chapter dealing with rotatable antennas. I made the reflector five percent larger than the driven element, using the formula, length in feet = 1050/f, and by using the formula, length in feet = 950/f, the first director was made five percent smaller. The sizes of these elements followed closely the sizes of the elements described in the article in the *Antenna Book*.

Now I had three directors to add. I knew the additional directors would decrease in size from the driven element, but not at the same five-percent rate. I made director #2 eight percent smaller than the driven, director #3 ten percent smaller, and director #4 eleven percent smaller than the driven element.

Here is a list of formulas for the length of each element, giving the distance around the loop in feet:

Reflector	—1050/f
Driven	—1000/f
Director 1	—950/f
Director 2	—920/f
Director 3	—900/f
Director 4	—890/f

The angle at the base of the loop should be 65 degrees, according to the article; the other two angles will be equal at 57.5 degrees each.



The ends of each outside element were flattened so that the top piece could be attached with 10 x 24 machine screws.

Now I had six elements. The next question was where to place them on the boom. The reflector and last director were easy, one on one end and one on the other. For the spacing of the other elements, I had to go back to the *ARRL Antenna Book*. In the chapter on "Multi-Element Directive Arrays," I found a table showing optimum element spacing for multi-element yagi arrays. In this table, the formula for the minimum and maximum distances between elements was given. The only thing I had to do was to choose a formula that stayed within the table's guidelines. I also had to remember that the spacings between all the elements had to add up to the length of the boom.

Keeping the above in mind, here are the formulas I came up with for the element spacing on my six-element delta loop, where L = wavelength in inches.

Reflector/Driven	= .17L
Driven/Director 1	= .15L
Director 1/Director 2	= .17L
Director 2/Director 3	= .22L
Director 3/Director 4	= .28L

Fig. 1. shows the antenna that I was going to build. (The formulas were used as starting points and the actual spacing varied slightly.)

Construction

Now that I had an idea on paper, the next step was to try to build the antenna, but first, I had to disassemble the TV antenna. It was put together almost entirely with rivets, easy to drill out to remove the elements. Everything worthwhile was salvaged. The phasing harness was made of heavy aluminum wire which I carefully straightened out and used later to make the top section of each delta loop. The wire was carefully measured out, for when I finished cutting the pieces that I needed there were only four inches left! One of the plastic insulators which was used on the phasing harness was later fashioned into the spacer for the gamma match.

When I removed the molded-plastic brackets which attached the elements to the boom, I discovered that these same brackets could be reworked to hold the elements in the vertical position rather than horizontal, as on the TV antenna.

Having already figured the dimensions of each of the six loops, I began to cut the elements that were removed from the TV antenna to form the outside elements of each loop on my antenna. The ends of the elements that had been attached to the brackets had been reinforced originally, so I used the same end to attach to the reused bracket on my antenna. The other ends were then flattened so that holes could be drilled in the flat portion to accept screws. After cutting and drilling, the outside elements were cleaned on a buffer to remove the oxidation from all the areas where a connection would be made.

Now each pair of outside elements was mounted to a plastic bracket. Originally done with a rivet, I used 10x24 machine screws. At this time each element looked as shown in a), in Fig. 2. Next, I took the heavy aluminum wire which was so carefully cut earlier and

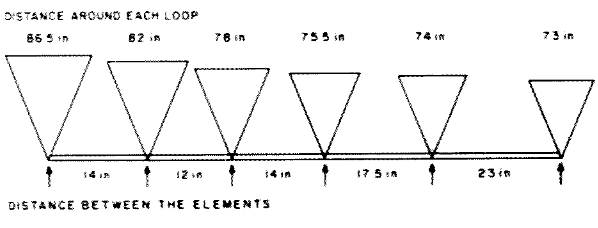


Fig. 1. Here are the dimensions I came up with to build the six-element delta loop.

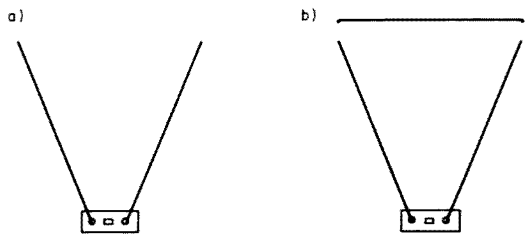


Fig. 2. With eyes formed in the ends of the horizontal pieces, they are attached to the ends of the outside elements, which were flattened and drilled earlier.

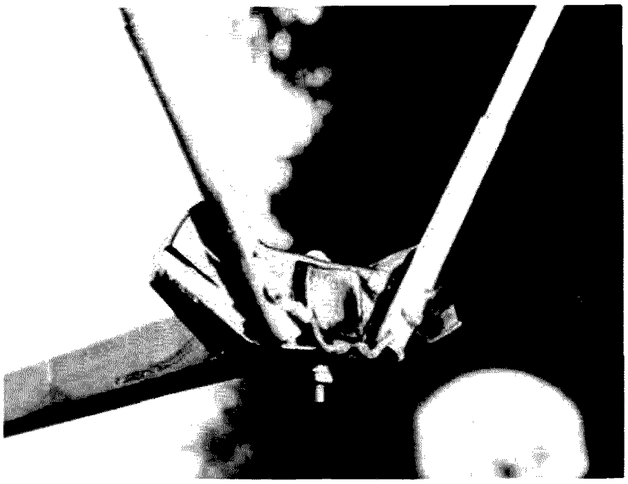
formed small eyes in the ends of each wire. Then each piece of wire was attached as the top horizontal piece of the element it was cut for. This also was done with 10 x 24 machine screws—see b) in Fig. 2.

Now that I had six complete elements, I drilled the boom at the points mentioned earlier. The boom and each plastic bracket were drilled so as to accept a 10 x 24 screw. Next, I slid each element onto the boom to its proper location.

Since each outside element was mounted to plastic, each loop was open at the bottom. Also, each element was insulated from the boom. To close each loop, I used #14 primary wire. At this time I also made each element common to the boom with the same wire. This was done simply because the article in the *Antenna Book* showed that the elements of the delta loop were all common to the boom. (At some later time I plan to make each element insulated from the boom to see what, if any, changes occur.)

Now that each element was mounted to its proper position on the boom, I had to figure a way to feed the antenna. The article showed that one way was with twinlead. This would not be acceptable for me as I had no way of matching it. The article also showed the antenna being fed through a gamma match made of RG-8 coax. I tried this, but it proved to be difficult to work with. After fumbling around with some other ideas, I decided to go back to the book.

It wasn't in the *ARRL Antenna Book*, but in an old amateur-radio handbook that I finally found the information I needed. (It's not what you know, but where you look!) There, an article showed a yagi for 144 MHz being fed through a variable capacitor (50 pF) and a gamma rod five inches long. I found a capacitor in the



A view of the bracket. Note the #14 wire strap that closes the loop and makes the element common to the boom.

junk box that I thought was around 0 to 30 pF, and the gamma rod was made from a piece of aluminum element from the TV antenna.

The capacitor should have sufficient plate spacing to handle some power. The five-inch gamma rod didn't tune quite the way I thought it should, so a seven-inch gamma rod was tried and seemed to give the proper match. I used a plastic insulator from the phasing harness on the TV antenna as a standoff for the gamma match and a hose clamp as a shorting strap. The variable capacitor was sealed in a plastic 35mm film can.

At this time I sealed all connections with spray-on clear lacquer. This included spraying the film can to make it air tight.

Theory

I am not an engineer, so I won't try to go into any detail on exactly how this antenna works. I read that the input impedance of a delta loop is slightly more than 100 Ohms. This will decrease somewhat with the addition of more elements. I also read in a book called *The VHF-UHF Handbook* that a good rule of thumb for finding the size of the variable capacitor on a gamma match is to allow 15 pF per meter of wavelength. This followed closely with what I used on my antenna.

The size of the driven element doesn't need to be exact because, like a quad, the delta loop seems to be broadbanded. All of my calculations were based on an antenna for 146 MHz, and the antenna was built and tuned to 146 MHz. A 30-Watt rig was used, and a wattmeter that read in reflected power, not swr. At either end of the band there was only a very slight amount of power being reflected, with the wattmeter showing a full 30-Watt output. Using a field-strength meter, there seemed to be a very narrow pattern off the front of the antenna and a small lobe off the back. I have not yet tried to draw a pattern of the antenna.

An antenna range was set up at the '84 Dayton Hamfest on Sunday of that event, by a group testing forward gain of home-brew and commercial antennas for 144, 220, 432, and 1269 MHz. I had my antenna tested there, and this six-element delta-loop antenna that I built from a scrap TV antenna produced 12.1 dB of gain with a gain density of 10.98. The officials said that the range produced slightly-higher-than-actual results for short-boom yagis. At any rate, I was very pleased with how well the antenna performed, and I also won a prize for the home-brew 144-MHz category.

Conclusion

This antenna is not original in design; the delta loop has been around for a long while. The formulas I used for element size and spacing can be found in books that could be in any ham's library. The point I wanted to make was that I took an old TV antenna that was destined for the trash can, did some research, worked out a few design problems, and built an antenna that performs as well as one costing ten times as much or more. I learned some things about antennas and about problems associated with VHF that don't occur at HF.

There are plenty of unused TV antennas in the air today with the ever-growing use of cable services. As a matter of fact, just about a month ago I took down a TV antenna for a friend, and the only fee was that I got to keep the antenna and the 30-foot mast pipe. I plan to make a seven-element yagi out of this antenna. With just a little looking around, one old TV antenna can be found to turn into a nice beam antenna for the VHF or UHF bands.

By the way, the "ham-in-space aficionados" have probably already checked out my call, but for the rest of you who might be reading this, no, my call was not one of those heard by Owen Garriott in the spacecraft, *Columbia*. I was, however, able to copy him on two separate passes across the Midwest!

Not too bad! ■

Parts List

TV antenna	$0.00
Capacitor	$0.00
Machine screws, nuts, washers, and hose clamp	$5.00
Total	$5.00

Dr. Frankenstein's CB Beam

Ravage the countryside with ten-meter rf! Create your antenna with refuse from the Citizen's Band graveyard.

Robert Matthews KA3JOM
1910 Altavue Road
Baltimore MD 21228

After receiving so many inquiries and letters from numerous countries throughout the world asking about the design and dimensions of my 10-meter antenna, I decided that it was time to write an article and reveal the facts about this unique piece of hardware. So, if you enjoy serious 10-meter DXing, read on.

The 10-meter band has always been my favorite band for good DX contacts. It has plenty of operating space with its 2 MHz of band spectrum. The 10-meter band is one of the best DX bands during the peak sunspot cycle, and during low sunspot activity it offers very good daytime DX propagation—provided you have an adequate antenna system.

If you're a Novice or have just upgraded to General class and have not yet decided which transceiver you would like to purchase, 10 meters offers a possible cheap solution: working QRP with a converted Citizens Band SSB transceiver. If you do not own one, they can be found at hamfests at reasonable prices.

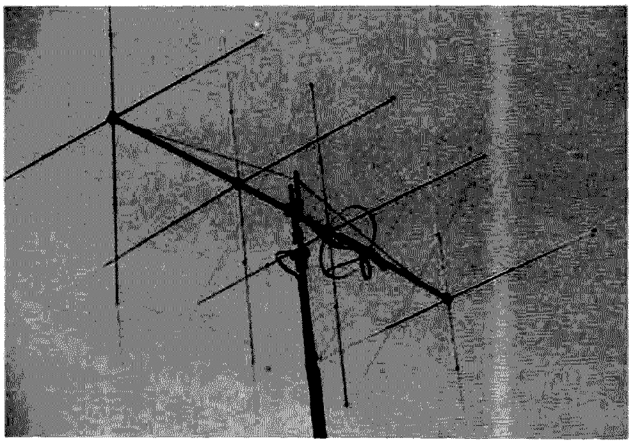


Photo A. The CB to 10-meter beam.

Living in a highly populated residential area, with television Channels 2 and 5 being watched regularly by neighbors, presented a problem for me with TVI complaints whenever I cranked up the amplifier on 10 meters. Every effort was made to tame the TVI which my amplifier caused, but the end result was that my signal was overpowering that of the television stations located forty miles away.

Thinking of how to increase my gain and directivity for DX communications on 10 meters led me to put the amplifier in the closet for a while and concentrate on a highly efficient antenna for my 10-meter operations. Obviously I couldn't erect a monstrous beam on a small residential lot, so whatever antenna I would choose to erect would have to have each element operating to its maximum efficiency.

The antenna I chose to build was a compromise between two of the leading directional antennas used in the 11-meter Citizens Band. These two antennas were manufactured by the Avanti Antenna Company: the PDL 2 and the Moonraker 4.

I chose the PDL 2 design for my driven element because of these factors:

- It is an actual 1½-wavelength antenna, claiming 5 dB gain over a ½-wave dipole.
- The system is easily adjustable with the gamma rods.
- The PDL 2 offers vertical as well as horizontal polarization.
- The end-to-end length of the element is only 13 feet.

The reflector was of quad design similar to that which is used with both the PDL and Moonraker.

The two directors used were yagi design as used in the Moonraker antenna. The use of quad directors did not show any benefits as far as gain or directivity, so the yagi-style directors from the Moonraker were utilized to keep antenna weight and size to a minimum.

Construction

Both the Moonraker 4 and the PDL 2 booms were used. Assemble the three Moonraker boom sections together to form a total length of 186 inches end to end. Do not fasten these sections until all elements and the mast mount are in place. The PDL boom section can be joined to the Moonraker boom with a wooden dowel or a short (two-foot) section of 1½-inch-diameter aluminum tubing.

Slide both boom sections together over the dowel (or the tube) until they meet. Drill 1/8-inch diameter holes in the ends of the booms; drill a total of six holes, three for each boom end. Make the holes about 120 degrees apart and about six inches from the seam where both booms are joined together. Refer to Fig. 1.

From the short PDL end of the boom assembly, measure exactly 36 inches from the end of the boom. Place a mark at this measurement with a scribe or marking pen. With a hacksaw, saw off this measured 36-inch piece of boom section and discard it. Now your entire boom length should be 207 inches end to end.

Assemble the quad reflector arms as per the PDL 2 instructions. The new length of wire for the reflector will be a total of 442 inches. Measure and mark your wire carefully. This will give each side 110.5 inches. Before tightening the hose clamps on the fiberglass spreaders, make sure that the quad reflector is not bowed due to over tension.

The PDL driven element is assembled as per the PDL instruction manual except for these minor changes: Measure the outer ½-inch aluminum elements from the flat end in and mark at 40 inches. Slide the outer tubing into the 5/8-inch inner tubing to this mark. Measure all four elements in this manner.

Next, the wire for the driven-element assembly must be measured. The wire will have a measurement end to end of 437 inches. This will give each side 109.25 inches. Measure this carefully. Adjust for proper tension as before in the reflector assembly.

Now, from the end of the boom which was sawed off, measure in exactly 87 inches. Place a mark at this point and drill a 1/8-inch hole in the boom. This will be used to anchor the plastic hub of the driven element to the boom assembly.

Temporarily slide off the larger 1¾-inch boom section from the Moonraker to allow installation of the driven-element assembly. Now hold up the boom, and from the end opposite to the one sawed, slide the assembled driven element onto the boom, with the globe-matching section going on first. Align the 1/8-inch hole in the boom with the hole in the plastic hub. I secured the plastic hub by using a 1¾" × 1/8 sheet-metal screw. Next, tighten the metal hub of the globe section. When all is tight, reinstall the larger boom section which was removed.

Now, from the sawed end, slide on the reflector and align the elements with those of the driven element. Tighten the hub, but make sure you have about half an inch of clearance from the hub to the edge of the boom.

After both elements are aligned, tighten all bolts securely. Now measure exactly 26 inches from the plastic hub out towards the front. Place a mark at this point on the boom. Next, slide on the mast mount from the Moonraker and center it at the marked point. Align the mast mount with the elements on the boom and tighten.

Next, assemble the two Moonraker directors as per the Moonraker instruction manual. Before tightening the hose clamps to secure the outer elements, label one element assembly #1 and the other assembly #2. Next, with a tape measure, set the element length of director #1 to 195 inches tip to tip. If you wish to retain the vertical elements, do the same with the other two elements on the hub.

If you wish not to have vertical polarization, then assemble the hub with all four of the 36-inch elements but use only the two outer elements in place for the horizontal polarization. After the tip-to-tip measurement of 195 inches is made, tighten the two hose clamps.

Next, slide the #1 director assembly onto the boom. Measuring it a distance of 56 inches from the plastic hub, align the #1 director with the

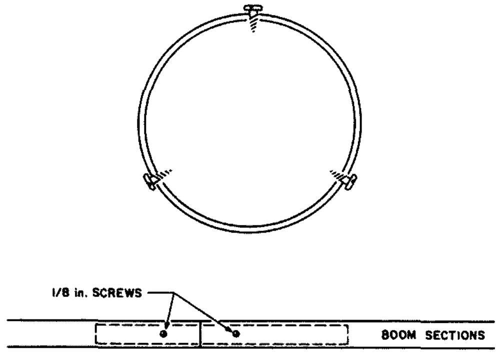


Fig. 1. The booms are joined together with a section of dowel.

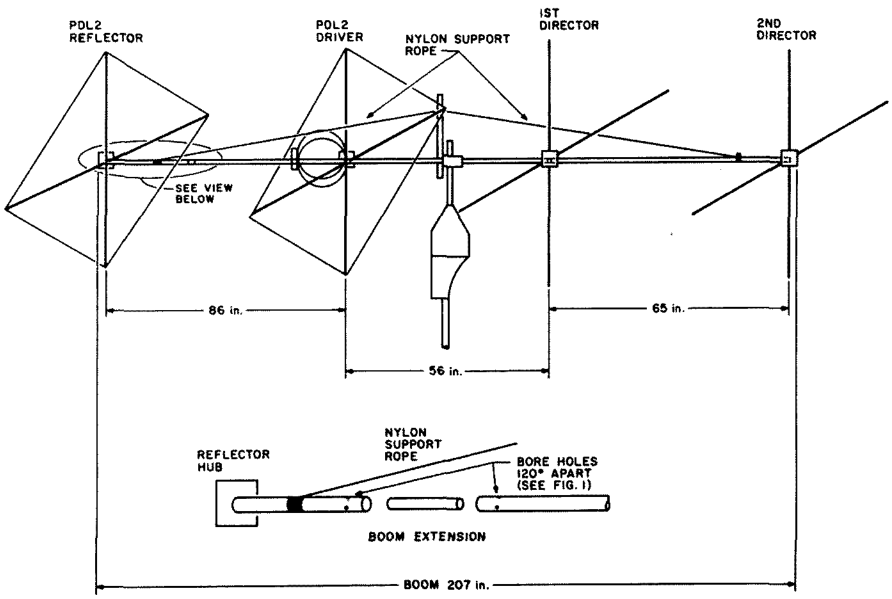


Fig. 2. Element spacing.

driven element and tighten it securely.

Assemble director #2 as per the instruction manual. The tip-to-tip measurement of this element is 192.5 inches. Remember, each half of an element must be the same length as the other half. Again, you may add the two elements for vertical polarization if you wish, keeping in mind that this is only an option, not a necessity.

Next, with a tape measure, measure a distance of 65 inches out from the #1 director. Make a mark at this point with a scribe. Slide on the #2 director assembly, align it with director #1, and tighten it to the boom at the point marked.

Adjustments

This completes the construction of the antenna assembly. Next comes the fun part, adjusting the swr. This is not really a big chore, though. After placing an swr meter at the antenna and signaling to my friend Gump Gardner to key the transmitter at low power, the adjustment produced a meter reading of 1.1 to 1 on 28,600 MHz. The use of the gamma rods really makes this job a pleasure. (Gump, by the way, helped me with the assembly, and also did the rough diagrams for this article.)

The shack installation was composed of RG-213/U; this cable has a velocity factor of .66 and is a good quality coaxial cable. The distance from the shack to the top of the tower was measured along with a few feet for slack. The total distance in coax was made in half-wave multiples. $(492 \times .66)/f$ = half wavelength of coax with a velocity factor of .66.

Now that we have most of the hard work done, it's time to get into the control seat and see just how well everyone else on the band can hear us with our new antenna; after all, isn't this what we're really concerned about?

The first station I heard was a CE7. Report was 59, not bad for only 50 Watts output. Next I received a ZL1. His report was 53, still not bad for the low wattage that I was running. Next station to call was a W7 in Arizona; the report he gave was 58 and loud and clear modulation.

Conclusion

Well, after having my converted CB beam up for over a year now, I must say that I'm pretty pleased with the results. Not only is the antenna working very well, but I am surprised when many of the hams I talk with begin asking me questions about the construction of my antenna. Many stations, especially the Europeans, send questionnaires along with their QSL cards. I knew that the antenna was working well for me, but I guess I really didn't realize how well others were receiving me and how interested they would be after learning that my output was only 50 Watts PEP.

The antenna is very broadbanded: 28.0 through 29.6 MHz. The highest the swr reached was 1.6 to 1. An amazing thing I discovered also was that the antenna had an swr reading of 1.7 to 1 on 21.2 MHz. The directivity wasn't as good on 15 meters, but it amazed me to have such a low swr on this band.

I hope that this article will answer a lot of questions for those of you wishing to build a good beam antenna for 10 meters. Anyway, it just goes to show that you don't need a big amplifier to talk where you want to—just a darn good antenna. Good luck and happy DXing! ■

BARTER 'N' BUY

Individual (noncommercial) .... 25¢ per word
Commercial .... 60¢ per word

Prepayment by check or money order is required with your ad. No discounts or commissions are available. Please make your payment to *73*. Rates for multiple insertions are available on request.

Advertising must pertain to amateur radio products or services. No special layouts or positions are possible. All advertising copy must be submitted typewritten (double-spaced) and must include full name and address. Copy limited to 100 words, maximum. Count only words in text. Address, free.

73 cannot verify advertising claims and cannot be held responsible for claims made by the advertiser. Liability will be limited to making any necessary corrections in the next available issue.

Copy must be received in Peterborough by the 5th of the second month preceding the cover date.

Make checks payable to *73* Magazine and send to: Ross Kenyon, Advertising Department, *73* Magazine, 80 Pine Street, Peterborough NH 03458.

MOBILE IGNITION SHIELDING. Free literature. Estes Engineering, 930 Marine Drive, Port Angeles WA 98362. BNB006

MILITARY TECHNICAL MANUALS for old and obsolete equipment. 60-page catalog, $3.00. Military Technical Manual Service, 2266 Senasac Ave., Long Beach CA 90815. BNB045

QSLS to order. Variety of styles, colors, card stock. W4BPD OSLs, PO Drawer DX, Cordova SC 29039. BNB260

THE DX'ERS MAGAZINE. Up-to-date, informative, interesting. Compiled and edited by Gus Browning W4BPD, OXCC Honor Roll Certificate #4. Send for *free* sample and subscription information today. PO Drawer DX, Cordova SC 29039. BNB261

COCO OWNERS—Free software and hardware brochure. CoCoNuts, POB 9866, San Jose CA 95157-0666. BNB265

CASH PAID for traffic/speed radar equipment. Write or call: Brian R. Esterman, PO Box 8141, Northfield IL 60093; (312)-251-8901. BNB271

COPY SATELLITE PHOTOGRAPHS, weather maps, and press on our military-surplus facsimile recorders. Recorders are solid-state, dual-speed, and fully automatic. Catalog available. Atlantic Sales, 3730 Nautilus Ave., Brooklyn NY 11224; (718)-372-0349. BNB280

$$$$$ SUPER SAVINGS on electronic parts, components, supplies, and computer accessories. Free 40-page catalog for SASE. Get on our mailing list. BCD Electro, PO Box 830119, Richardson TX 75083; (214)-690-1102. BNB289

FIND OUT what else you can hear on your general-coverage transceiver or receiver. Join a shortwave radio listening club. Complete information on major North American clubs and sample newsletter, $1.00. Association of North American Radio Clubs, 1500 Bunbury Drive, Whittier CA 90601. BNB310

INDIVIDUAL PHOTOFACT FOLDERS: #1 to #1400 $3.00 postpaid. AJL, 414 Chestnut Lane, East Meadow NY 11554. BNB312

CX7 REPAIRS. Mark Mandelkern, 2315 Derby St., Berkeley CA 94705; (415)-549-9210. BNB320

DX ADVENTURE on Montserrat, only $250/week. Details: Chod Harris VP2ML, Box 4881-7, Santa Rosa CA 95402. BNB321

IMRA—International Mission Radio Association. Forty countries, 800 members. Assists missionaries with equipment loaned, weekday net. 14.280 MHz, 2:00-3:00 pm Eastern. Brother Bernard Frey, 1 Pryer Manor Road, Larchmont NY 10538. BNB326

FREE: 100 OSLs with first order. Samples 50¢. Gazebo Press, Rt. 4 Box 4148, LaPlata MD 20648. BNB327

ELECTRON TUBES: receiving, transmitting, microwave...all types available. Large inventory means next-day shipment in most cases. Daily Electronics, PO Box 5029, Compton CA 90224; (213)-774-1255. BNB330

WANTED: radios, tubes pre-1939 for my collection. Howard Stone, HCR-3, Box 418, Deer River MN 56636. BNB332

CODE-PRACTICE PROGRAMS diskette for IBM PC, PC/jr. $10.00 ppd. Andrew Modla/73/N3EGH, 5 Derby Place, Newtown PA 18940. BNB334

HAM TRADER YELLOW SHEETS, in our 24th year. Buy, swap, sell ham-radio gear. Published twice a month. Ads quickly circulate—no long wait for results. SASE for sample copy. $10.00 for one year (24 issues). PO Box 356, Wheaton IL 60189. BNB335

COMMODORE Authorized Service Center, 24-hr. service. WA2AJQ, 303 S. Vermont Ave., Royal Oak MI 48067; (313)-399-3990. BNB337

DIGITAL AUTOMATIC DISPLAYS for FT-101s, TS-520s, Collins, Swan, and all others. Six ½" digits in a 5" wide by 1¼" high and 9" deep metal cabinet. Send $1.00 for information. Grand Systems, Dept. A, PO Box 3377, Blaine WA 98230. Canadians VE7LB. BNB341

RADIO TRANSCRIPTION DISCS WANTED. Any size, speed. W7FIZ, Box 724—WG, Redmond WA 98073-0724. BNB347

CABLE CONVERTERS. Lowest price. Dealer inquiries accepted. Quantity discounts. Free catalog. P.G. Video Corp., 61 Gatchell St., Dept. 73, Buffalo NY 14212. BNB349

TOO MANY MICROPHONES on your operating desk? With the SISCO model 612 mike control you can now use one microphone with several rigs. Prices start at $15.95. Southern Instrumentation, PO Box 5097, Ormond Beach FL 32074; (904)-673-1059. BNB351

MOVING TO CENTRAL FLORIDA? Beautiful QTH, minutes from Disney World, 2,700 air-conditioned square feet, lovely half-acre wooded lot, prestigious neighborhood. Three bedrooms, two baths, fireplace, sophisticated ham shack, game room, screened porch, sun deck, separate matching 600-square-foot utility building (ideal for workshop or in-law suite). Furnishings possible. Includes 160' Rohn 45G construction tower, Wilson 5-element monobanders (10, 15, and 20 meters), inverted-V dipoles (40 and 80 meters), 13' Earth-station satellite system. Many other amenities. Superlative QTH for retiring radio amateur. $175,000, terms negotiable. For information, pictures, etc., call Don W4JTK, (305)-298-3116, or write (address OK in *Callbook*). (Moving to $300,000 home next door!) BNB355

COMMODORE 64 CW INSTRUCTOR PROGRAM. Generates CW on TV speaker. Random code, keyboard input, or prerecorded "CW Tests." Character speed and spacing set independently. Designed for classes and increasing code speed. $15.00—diskette or cassette (specify). Dennis Olver N7BCU, 22000 S. Tonya Ct., Beavercreek OR 97004. BNB357

SEPTEMBER 8: The 43rd annual Findlay Hamfest, sponsored by the Findlay Radio Club, will be held at the Hancock County Fairgrounds on Sunday, September 8, 1985, from 6:30 am to 5:00 pm. Advance tickets are $3.00; $4.00 at the door. Cut-off for advance tickets is September 1. Tables are $6.00 each. Outdoor flea-market spaces are $3.00 each. Talk-in on 147.75/.15. For more information, write to the Findlay Radio Club, PO Box 587, Findlay OH 45839. BNB361

PRIME SPACE on the classroom wall awaits your super QSL. In return we might send you our QSL of the Week Award. Send your card today and no matter what you will get hung in the Big Apple. WB2JKJ's Crew at Junior High School 22 on Manhattan's Lower East Side wants your wallpaper. BNB362

HAMSWAP newsletter—send us your *free ad.* Include phone. Buy/sell/trade. Subscriber equipment discounts. 12 issues $9.00. *HamSwap,* PO Box 420171, Sacramento CA 95842. BNB363

PROGRAMMED EPROMS AND PROMS: 82S23/123, 82S126/129 fusible link, $6.00 each; 2708, 2716 (+5 V), 2732 (+5 V) EPROMS, $9.00 each postpaid. Send coding list, hexadecimal format to Douglas Hall, 6434 Mella Street, Springfield VA 22150. BNB364

FOR SALE: Heath HW-101 with power supply, $225. HBO descrambler filter schematic, $2.00. Send an SASE to J. C., PO Box 6349, Evansville IN 47712. BNB365

ROHN TOWERS—wholesale direct to users. 23% to 34% discount from dealer price. All products available. Write or call for price list. Also we are wholesale distributor for Heliax antenna cable. Hill Radio, 2503 G E Road, PO Box 1405, Bloomington IL 61701-1405; (309)-663-2141. BNB366

CIRCUIT HACKER WANTED to design and build audio modification device to specs for voice and music. Pay for time and materials. Boston area ideal. Circuit, Box 1054, Merrimack NH 03054. BNB367

LOWEST PRICES for meters, switches, transformers, and power supplies. Free catalog for SASE. Electronic Design and Sales, PO Box 502, Columbus NE 68601. BNB368

BURGLAR ALARMS—BUSINESS BOOMING. Get in now. Easily learned. Terrific employment/business opportunities. Starting information $2.00. Security Electronics International, PO Box 1456-R, Grand Rapids MI 49501. BNB389

ELECTRON TUBES—Radio and TV types 75% off list price—huge inventory! Also, industrial types. Send for free catalog today or call toll-free (800)-221-5802. Box SC, Transleteronics, Inc., 1365 39th St., Brooklyn NY 11218. See our display ad in this issue. BNB370

NEW! CW WORD-COPYING COURSE Easy to learn. Complete. QSO-Trainer™ code course. Send $16.95 (Indiana add $0.85). Money-back, satisfaction guarantee (less $2.00 shipping and handling). Business-size SASE gets free information. AVC Innovations, Inc., Department 7C2, PO Box 20491, Indianapolis IN 46220-0491. BNB371

SPECIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine *by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices,* 73 Mag*azine, Pine St., Peterborough NH 03458.*

TRUMANSBURG NY
AUG 24

The TCARC will sponsor the Fingerlakes Hamfest and Giant Flea Market on Saturday, August 24, 1985, at the Trumansburg Fairgrounds, Route 96, 12 miles north of Ithaca NY. There will be a $2.00 donation at the gate (children under 12 are free). Flea-market parking is $1.00. Indoor tables are $5.00. Talk-in on .37/.97 or .52 simplex. For further information, write TCARC, c/o David G. Flinn, 866 Ridge Road, Lansing NY 14882; (607)-533-4297.

MARSHALL MI
AUG 25

The sixth annual Trunk and Trailer Bash will be held on Sunday, August 25, 1985, from 8:00 am to 3:00 pm, at the Calhoun

County Fairgrounds, Marshall MI. Donation is $2.00 per space and tables are $3.00. Overnight camping is available for an extra charge. For more information, contact CARES, c/o Earl K8UCQ, 110 Perrett Road, Marshall MI 49068; (616)-781-5555.

SEWELL NJ
AUG 25

The Gloucester County Amateur Radio Club will sponsor Hamfest 85 on Sunday, August 25, 1985, from 8:00 am to 4:00 pm, at Gloucester County College, Sewell NJ. Setup is at 7:00 am. Tickets are $2.50 in advance and $3.00 at the gate. Features include a flea market and displays of amateur-radio and computer equipment. Food and refreshments will be available. For information or advance tickets, write to GCARC, PO Box 370, Pitman NJ 08071.

OK CORRAL
TOMBSTONE AZ
AUG 31-SEP 2

Special-event station W7GV will operate from the 4th annual Rendezvous of the Gunfighters, on Labor Day weekend, from the OK Corral, Tombstone AZ. The OK Corral was the site of the shoot-out between the Earp and Clanton factions in 1881. W7GV is the oldest active amateur-radio call in the state. Operations will begin at 1500 UTC, August 31, and will run through 2200 UTC, September 2. Frequencies will be: SSB—28680, 21380, 14280, 7280, and 3730; CW—21130, 7130, and 3730. A certificate will be awarded to all who work W7GV, as well as SWLs. Please send a large 8-1/2 × 11 SASE (40 cents postage) to W7GV, PO Box 36032, Tucson AZ 85741.

LABOR DAY SAFETY
AUG 31-SEP 2

The Tri-City ARC will operate special-event station KA1BB from the Waterford CT I-95 weigh station to promote safe Labor Day holiday auto travel. This event is in conjunction with the third annual Stay-Awake Coffee Stop sponsored by BSA Troop 24 of Niantic CT. Mobile operators are especially encouraged to call. Operation will be from 1700 UTC, August 31, 1985, through 2300 UTC, September 2, 1985, on 14.295, 7.245, and 3.895 MHz phone and 7.130 MHz CW. Talk-in to the coffee stop will be on 146.52 simplex and CB channel 19. QSL via Tri-City ARC, PO Box 686, Groton CT 06340. For further information, please contact Bob Dargel KA1BB, 8 Willow Lane, East Lyme CT 06333; (203)-739-8016 or (203)-446-7325.

BLOOMINGTON IN
SEP 1

The 8th annual Bloomington Hamfest will be held on Sunday, September 1, 1985, from 8:00 am until 2:00 pm, at the 147.18/.78 repeater site, 2335 Vernal Pike off SR 37 bypass. Admission is $2.00. Food will be available. There will be no charge for selling; bring your own table. For FCC VE exams, contact K9PS for details and exam times. For further information, send an SASE to Bob Myers K9KTH, 306 S. Fairview St., Bloomington IN 47401; (812)-332-1105.

LARAMIE-CHEYENNE WY
SEP 6-8

The SHY-WY ARC, the University of Wyoming ARC, and the Northern Colorado ARC will sponsor the sixth annual High Plains Ham Roundup on September 6-8, 1985, in the Medicine Bow National Forest, Yellow Pine Campground, 14 miles east of Laramie, or 35 miles west of Cheyenne, on Interstate Highway 80. Features will include a potluck supper, swapfest, packet-radio demonstration, hat-decorating contest for XYLs and YLs, musical entertainment, and campfire sing-along. There will be no registration fees except a modest Forest Service charge for campers. Talk-in on 146.22/.82 and 146.25/.85. For further information, write to KØHRS, 2204 Vassar Avenue, Fort Collins CO 80525.

WINDSOR ME
SEP 7

The Augusta Emergency Amateur Radio Unit will sponsor the 1985 ARRL-sanctioned Windsor Hamfest on Saturday, September 7, 1985, at the Windsor ME Fairgrounds. Gate donation is $1.00, and camping is $3.00 per night or $5.00 for two nights. There will be a flea market, programs, speakers, commercial distributors, light meals, and the traditional Saturday bean and casserole supper. Talk-in on 146.22/.82. For further information, contact Ron Dishman N1CMZ, 37 Marlboro Avenue, Augusta ME 04330; (207)-623-8351.

UNIONTOWN PA
SEP 7

The Uniontown Amateur Radio Club will hold its 36th annual Gabfest on Saturday, September 7, 1985, on the club grounds located on the Old Pittsburgh Road, just off Rt. 51 and the 119 bypass, in Uniontown PA. Registration is $3.00 each or 2 for $5.00. There will be free parking, free coffee, and free swap and shop with registration. There will be plenty of good food at the refreshment stand. Talk-in on 147.645/.045 and 144.57/.17. For further information, contact UARC Gabfest Committee, c/o John T. Cermak WB3DOD, PO Box 433, Republic PA 15475; (412)-246-2870.

BATTLE OF LAKE ERIE
SEP 7-8

The Radio Association of Erie will operate special-event station W3GV on September 7-8, 1985, from 9:00 am to 9:00 pm on Saturday and from 9:00 am to 5:00 pm on Sunday, to commemorate Commodore Oliver Hazard Perry's victory at the Battle of Lake Erie during the War of 1812. Frequencies are 7.235 and 14.235 (phone) and 7.090 and 14.090 (CW/RTTY). For a special QSL, send a business-size SASE to W3GV, 380 Young Road, Erie PA 16509. DX stations use the W3 QSL bureau.

HANCOCK COUNTY OH
SEP 8

The Findlay Radio Club will sponsor the 43rd annual Findlay Hamfest on Sunday, September 8, 1985, from 6:30 am to 5:00 pm, at the Hancock County (Ohio) Fairgrounds. Tickets are $3.00 in advance and $4.00 at the door. Tables are $6.00, and outdoor flea-market spaces are $3.00. Talk-in on 147.75/.15. For more information, contact the Findlay Radio Club, PO Box 587, Findlay OH 45839.

WILLOW SPRINGS IL
SEP 8

The Bolingbrook Amateur Radio Society will hold BARS Hamfest 85 on Sunday, September 8, 1985, at Santa Fe Park, 91st Street and Wolf Road, Willow Springs IL. Admission is $2.00 in advance and $3.00 at the gate. Overnight parking will be available. Food will be available. Talk-in on 147.33/.93 and 146.52. For more information, contact Ed Weinstein WD9AYR, 7511 Walnut Avenue, Woodridge IL 60517; (312)-985-0527.

MONETT MO
SEP 8

The Ozarks Amateur Radio Society will sponsor the 4th annual Ozark Amateur Radio Club Congress and Swapfest at City Park, junction of US Highway 60 and Missouri State Highway 37, Monett MO, on Sunday, September 8, 1985. There will be a swapfest at 11:00 am and a buffet dinner at 1:00 pm. No tickets are necessary. All amateurs and families are welcome. Talk-in on 146.37/.97 MHz, 146.52 MHz, and 7.250 MHz. For more information, write or call the Ozarks Amateur Radio Society, Box 327, Aurora MO 65605; (417)-678-5330.

GREAT SALT PLAINS LAKE
SEP 8

The third annual Great Salt Plains Ham Social (serving the Oklahoma-Kansas state line area) will be held on September 8, 1985, at the community building on the south side of Great Salt Plains Lake. Free swap tables and refreshments will be available. Talk-in on 147.90/.30. For more information, contact Steven Walz WA5UTO, PO Box 222, Cherokee OK 73728; (405)-596-3487.

OLD BRIDGE NJ
SEP 8

The Old Bridge Radio Association will hold its annual OBRA Auction on Sunday, September 8, 1985, beginning at 9:00 am (8:00 am for sellers), at the Knights of Columbus Hall on Pace Street, Old Bridge NJ (seven miles south of NJ Turnpike Exit 9 on Route 18). Talk-in on 147.120/.720 and 146.520 simplex. This is *not* a flea market. For more information, send an SASE to WA2JAJ.

BUTLER PA
SEP 8

The Butler County ARA will sponsor a hamfest on Sunday, September 8, 1985, from 9:00 am to 4:00 pm, at the Butler Farm Show Grounds, Roe Airport, Butler PA. Admission is $1.00, with children under 12 going free. There will be plenty of parking; overnight campers are welcome. There will be a free outside flea market; 8-ft tables will cost $5.00. Talk-in on 147.96/.36. For more information, contact Hamfest Chairman, PO Box 1787, Butler PA 16003.

QUEENS NY
SEP 8

The Hall of Science Amateur Radio Club will sponsor a hamfest at the Hall of Science Parking Lot, Flushing Meadow Park, 47-01 111th Street, Corona, Queens NY, on Sunday, September 8, 1985, from 9:00 am to 4:00 pm. Donation will be $3.00 for buyers; $5.00 per space for sellers. Talk-in frequencies are 144.250 simplex link, 223.600 repeat, 445.225 repeat. For further information, contact John Powers KA2AHJ at (718)-847-8007 or Arnie Schiffman WB2YXB at (718)-343-0172.

MISS AMERICA
SEP 10-14

The Southern Counties Amateur Radio Association, Inc., will again sponsor special-event station K2BR during the Miss America Pageant week in Atlantic City NJ, from Tuesday, September 10, 1985, to Saturday, September 14, 1985. Frequencies will be 25 kHz inside General phone bands, with CW 65 kHz up from the lower band edges. Novice frequencies will be 7.125 and 21.250 MHz. QSL with an SASE via SCARA, Box 121, Linwood NJ 08221.

JOHNNY APPLESEED
SEP 12-14

The Columbiana County ARC will operate special-event station N8DKX on September 12-14, 1985, from 2200 UTC to 0100 UTC each day, to commemorate the annual Johnny Appleseed Festival in Lisbon OH. Operation will be 10 to 20 kHz up from

the bottom edge of the General-class phone bands. For a certificate, send a QSL and an SASE to N8DKX, 6008 Camp Boulevard, Lisbon OH 44432.

MICHIGAN TECH
SEP 13-22

The Michigan Technological University Amateur Radio Club will operate special-event station W8YY on September 13-22, 1985, to celebrate the University's centennial and the MTUARC's golden anniversary. Frequencies are as follows: CW—3.745, 7.145, 10.145, 14.070, and 21.445; phone—1.845, 3.995, 7.285, 21.445, and 144.200; RTTY—3.625, 7.095, and 14.095; OSCAR when in range. For a commemorative certificate, send OSL and a large SASE to Debbie Parmer, c/o W8YY, W. Wadsworth Hall, MTU, Houghton MI 49931.

BEAR BRYANT
SEP 14

The West Alabama Amateur Radio Society (WAARS) will operate special-event station W4DAT on Saturday, September 14, 1985, in remembrance of the greatest college football coach in history, Paul "Bear" Bryant. The Bear Bryant Station will operate from the campus of the University of Alabama from 1300 UTC to 2400 UTC. Phone frequencies will be the bottom 25 kHz of the General 40-10-meter phone bands. WAARS will also work Novices on the bottom 25 kHz of the Novice bands. For further information, write to the West Alabama ARS, PO Box 1741, Tuscaloosa AL 35403.

NIAGARA FALLS NY
SEP 14

The 1985 Ham-O-Rama will be held on Saturday, September 14, 1985, at the Niagara Falls International Convention Center, Niagara Falls NY. General admission will be $3.50 in advance (before August 24) and $5.00 at gate. Outside flea-market spaces are $5.00. Inside flea-market tables are $15.00. Features include new-equipment displays, computer displays, technical programs, FCC exams, net and association meetings, and the annual W2RUF memorial code-proficiency test. (For more information about the proficiency test, call Kevin WA2FKV at (716)-834-3042 after 6:00 pm.) Talk-in on 146.31/.91 and 146.52 simplex. For further information, contact Nelson Oldfield, 126 Greenaway Blvd., Cheektowaga NY 14225.

MOUNTAIN STATE AWARD
SEP 14-15

The Logan County ARC will hold its fifth annual "Mountain State Award" expedition from a West Virginia mountaintop in Logan County from 1600 UTC, September 14, 1985, to 0200 UTC, September 15, 1985. Phone operating frequencies will be approximately 25 kHz from the low end of the General 80- and 40-meter phone bands, as propagation allows. The callsign will be KJ8E. A handsome 8" × 10" certificate will be awarded to all contacts submitting a QSL and a legal-size SASE to Robert T. Johnson W8VEN, PO Box 320, Stollings WV 25646.

USECA
SEP 14-15

Members of the Utica-Shelby Emergency Communications Association will operate two special-event stations from 1300 UTC on Saturday, September 14, 1985, to 0400 UTC on Sunday, September 15, 1985, to celebrate the first air-to-ground public telephone service which was inaugurated between Chicago and Detroit in 1957. KA8KTV will be on 80, 40, 20, 15, and 10 meters, depending on propagation. CW will be in Novice portions only, except on 20 meters. K8QLM will be on 147.18/.78. A special QSL will be sent out to all stations making contact with either of the 2 stations on either day using any mode. A special certificate will be awarded to stations that make contact with the same station operator on 2 different days, 2 different bands and/or 2 different modes. Send a large SASE to USECA, PO Box 291, Utica MI 48087.

CINCINNATI OH
SEP 15

The Greater Cincinnati Amateur Radio Association, Inc., will sponsor its annual hamfest on Sunday, September 15, 1985, at Stricker's Grove on State Route 128, one mile west of Venice (Ross), Ohio. There will be exhibits, booths, food and refreshments, a flea market, music, talks, a hidden-transmitter hunt, and a sensa-

tional air show. Admission and registration will be $5.00. For information, contact Lillian Abbott K8CKI, 317 Greenwell Road, Cincinnati OH 45238.

NEW KENSINGTON PA
SEP 15

The Skyview Radio Society will hold its annual hamfest on Sunday, September 15, 1985, from 12:00 noon to 4:00 pm, at the club grounds, Turkey Ridge Road, New Kensington PA. Admission is $2.00 ($4.00 for vendors). Talk-in on 146.04/.64 and .52.

PENNSAUKEN NJ
SEP 15

The South Jersey Radio Association will hold its 37th annual hamfest on Sunday, September 15, 1985, at the Pennsauken High School on Hylton Road, Pennsauken NJ. Admission is $2.50 in advance and $3.00 at the door. Gates will open at 8:00 am. Tailgating spaces are $5.00 each. There will be refreshments and food in the school cafeteria. Talk-in on 145.29/144.69. For more information, contact Fred Holler W2EKB, 348 Bortons Mill Road, Cherry Hill NJ 08034; (609)-795-0577.

NEWTOWN CT
SEP 15

The Candlewood Amateur Radio Association (CARA) will hold its annual flea market at Edmond Town Hall, Main Street (Route 6), Newtown CT, on Sunday, September 15, 1985, from 10:00 am to 4:00 pm (dealers may set up at 9:00 am). Admission is $2.00; tables are $7.00; tailgating is $5.00. Talk-in on 147.72/.12 or .52 simplex. For table reservations, send a check or money order to CARA, PO Box 143, Bethel CT 06801. For further information, contact Gene Marino W1IDH, Valley View Road, Newtown CT 06470; (203)-426-8852.

MT. CLEMENS MI
SEP 15

The L'Anse Creuse ARC will present its 13th annual Swap and Shop on Sunday, September 15, 1985, at the L'Anse Creuse High School, Mt. Clemens MI, from 8:00 am to 3:00 pm. Tickets are $1.00 in advance, $2.00 at the door. Trunk sales are $4.00 per space; tables inside are $8.00 each. Talk-in on 147.69/.09 and 146.52. For tickets or table reservations, send an SASE to Maurice Schietecatte N8CEO, 15835 Touraine Ct., Mt. Clemens MI 48044; (313)-286-1843.

LITTLE BROWN JUG
SEP 18-19

The Delaware County (OH) Amateur Radio Association, Inc., will operate Little Brown Jug special-event station W8QLS on Saturday and Sunday, September 18–19, 1985, from 9:00 am to 8:00 pm, from the Delaware County Fair. Frequencies are 3860, 7235, and 14,235 (plus or minus). To QSL, send an SASE to W8QLS, c/o Staff Stafford NJ8F, 5987 Dublin Road, Delaware OH 43015.

GREENSBORO NC
SEP 19-21

The Personal Computer and Standard Computer Interfacing for Scientific Instrument Automation Workshop, sponsored by Virginia Tech, will be held September 19-21, 1985, in Greensboro NC. The cost is $450 for the three-day session. This is a hands-on workshop, with each participant wiring and testing interfaces. The course will be directed by Mr. David E. Larsen and Dr. Paul E. Field. For more information, contact Dr. Linda Leffel, C.E.C., Virginia Tech, Blacksburg VA 24061; (703)-961-4848.

HOUSTON TX
SEP 20-22

Houston Ham Conventions, Inc., will sponsor Houston Com-Vention 85 from Friday, September 20, 1985, through Sunday, September 22, 1985, at the Stouffer Greenway Plaza Hotel, Southwest Freeway (US 59) and Edloe Street, five miles southwest of Houston TX. Registration opens at 5:00 pm Friday night. Saturday hours are 8:00 am to 5:00 pm; Sunday hours are 9:00 am to 3:00 pm. Features include an indoor flea market, forums, commercial exhibits, alternate activities, and a Saturday-night Texas BBQ dinner. Parking is free. For more information, call (713)-333-1466.

GRAND RAPIDS MI
SEP 21

The Grand Rapids Amateur Radio Association will hold its annual Swap and Shop on Saturday, September 21, 1985, at the Hudsonville Fairgrounds. There will be dealers, an indoor sales area, and an outdoor trunk swap area. Gates will open at 8:00 am. Talk-in on 146.16/.76. For more information, write to the Grand Rapids Amateur Radio Association, PO Box 1248, Grand Rapids MI 49501.

SEBASTOPOL CA
SEP 21

The Sonoma County Radio Amateurs, Inc., will sponsor its third annual ham-radio flea market on Saturday, September 21, 1985, from 8:00 am to 2:00 pm, at the Sebastopol Community Center, 390 Morris Street, Sebastopol CA (5 miles west of Santa Rosa just off Highway 12). This is the largest ham flea market on the north coast. Admission and parking are free. Tables are $6.00 at the door or $5.00 in advance. Vendor setup starts at 7:00 am. Talk-in on 146.13/.73. Features include a radio clinic, exhibits, refreshments, and an auction at about noon. For further information or tickets, write SCRA, Box 116, Santa Rosa CA 95402.

HARTFORD CT
SEP 21-22

The Connecticut DX Association and the Newington Amateur Radio League will celebrate Connecticut's 350th anniversary by operating special-event station KW1V from the grounds of the State Capitol in Hartford CT, on Saturday and Sunday, September 21-22, 1985, on the General and Advanced US phone bands. Operation will be from 1400 UTC on September 21 to 0100 UTC on September 22, and from 1400 UTC to 2100 UTC on September 22. For a special QSL card, send a #10 SASE with 39 cents postage to Dave Rose KW1V, 13 Long Crossing Road, East Hampton CT 06424.

BEREA OH
SEP 21-22

The Cleveland Hamfest and Computer Show will be held on Sunday, September 22, 1985, from 8:00 am to 5:00 pm, at the Cuyahoga County Fairgrounds, Berea OH. Admission is $3.00 in advance and $3.50 at the gate (under 12 free). Indoor tables are $10.00 for an 8-foot space and $8.00 for each additional 8-foot space (includes table and chairs; set up Saturday 12:00 to 5:00 pm and Sunday from 6:00 am on). Outdoor flea-market spaces are $4.00 each (overnight parking will be available). Features include commercial exhibits, NASA displays, speaker programs on AMSAT, DX, packet, and FCC, walk-in license exams, non-ham activities, and free parking. A banquet will be held on Saturday, September 21, 1985, with cocktails at 6:00 pm and a buffet dinner at 7:00 pm, at the Bagley Hotel Ballroom, 17000 Bagley Road, Middleburg Heights OH (just east of the I-71/Bagley Road interchange). For banquet reservations, call Barbara Ernest N8DAD at 327-3914. For advance hamfest tickets or further information, write to the Cleveland Hamfest Association, PO Box 93077, Cleveland OH 44101.

VIRGINIA BEACH VA
SEP 21-22

The Tidewater Radio Conventions, Inc., is sponsoring the 1985 ARRL Virginia State Convention and 10th annual Amateur Radio/Computer Fair on Saturday and Sunday, September 21 and 22, 1985, from 9:00 am to 5:00 pm, at the Virginia Beach, Virginia, Pavilion. Advance admission tickets for both days are $5.00. Tickets at the door will be $6.00. Flea-market tables will be $5.00 for one day, $8.00 for both days. Featured activities include dealers, special displays, forums, computer equipment, ARRL license exams, free XYL bingo, and movies for the kids. For information and tickets, write or call Jim Harrison N4NV, 1234 Little Bay Avenue, Norfolk VA 23503; (804)-587-1695.

BRAINERD MN
SEP 21-22

The Paul Bunyan Wireless Association will operate a special-event station from 1500 UTC on Saturday, September 21, 1985, to 2100 UTC on Sunday, September 22, 1985, from the Paul Bunyan Festival near Brainerd MN. Phone and CW operation will be in the lower part of the General-class 80-10-meter bands. For a commemorative QSL, send an SASE to the Paul Bunyan Wireless Association, PO Box 354, Pequot Lakes MN 56472.

PEORIA IL
SEP 21-22

The Peoria Area Amateur Radio Club will sponsor Superfest 85 at the Exposition Gardens, W. Northmoor Road, Peoria IL, on Saturday and Sunday, September 21-22, 1985. Gates open at 6:00 am; the commercial building will open at 9:00 am. Admission will be $3.00 in advance and $4.00 at the gate. Children under 12 are free. Activities will include amateur-radio and computer displays, a huge flea market, FCC exams for all classes on Saturday only, and a free bus to Northwoods Mall on Sunday. There will be full camping facilities on the grounds. Talk-in on 146.16/.76 (W9UVI). Information or reservations are available for an SASE to Superfest 85, PO Box 3461, Peoria IL 61614.

YORK PA
SEP 21-22

The York Hamfest Committee will present its annual hamfest on Saturday and Sunday, September 21 and 22, 1985, at the York Fairgrounds, State Route 74, York PA. Registration will be $2.00 on Saturday, $4.00 on Sunday, or $5.00 for both days. XYLs and junior ops under 12 will be free. There will be a Saturday-evening banquet ($10.00—by advance registration only). Tailgating (10-foot space) will be $4.00/day or $6.00 for both days. Indoor display area tables will be $5.00 and up per day. Vendor setup will be at 6:00 am and registration will be at 8:00 am both days. For more information or reservations, contact the York Hamfest, Box W, Dover PA 17315.

NEW BERLIN IL
SEP 22

The Sangamon County Fair Association will sponsor the 10th annual New Berlin Hamfest on Sunday, September 22, 1985, from 7:00 am to 3:00 pm, at the Sangamon County Fairgrounds in New Berlin IL. Ad-

mission and flea-market setup is free and talk-in will be on 146.52 and 146.88. Food and drink will be available. The hamfest will be held rain or shine. For more information, contact Al Swettman K9OFR, Box 2, Pleasant Plains IL 62677; (217)-626-1634.

OLD WESTBURY NY
SEP 22

The Long Island Hamfair will be held on Sunday, September 22, 1985, at the New York Institute of Technology, on Route 25A, Northern Boulevard, Old Westbury NY (1/2 mile east of Glen Cove Road). General admission is $3.00. Wives, children, and sweethearts are free. There will be a $5.00 charge per car space for exhibitors. Talk-in on 146.85. For further information, call Hank Wener WB2ALW at (516)-484-4322 (nights) or Bob Reed WB2DIN at (516)-221-8116.

WOONSOCKET RI
SEP 22

The Rhode Island Amateur FM Repeater Service, Inc., will hold its annual fall flea market on Saturday, September 22, 1985, beginning at 9:00 am, at the American Legion Fairmont Post 85, 870 River Street, Woonsocket RI. Admission is free. Flea-market spaces are $5.00. An auction will begin at noon. Talk-in on .34/.94 and .52 simplex. For more information, contact Richard Fairweather K1KYI, 127 Sherman Farm Road, Harrisville RI 02830; (401)-568-3468.

GAINESVILLE GA
SEP 22

The 12th annual Lanierland ARC Hamfest will be held on Sunday, September 22, 1985, beginning at 9:00 am, in the Holiday Hall of the Holiday Inn, Gainesville GA. There will be free tables and an inside display area for dealers reserving in advance. There is a large parking lot for the free flea market. There will be many activities and a ladies country store. Novice through Extra walk-in exams will begin at 9:00 am. Talk-in on 146.07/.67. For information or reservations, contact Paul Watkins W4FDK, Route 11, Box 536, Gainesville GA 30501; (404)-536-8280.

WILLIMANTIC CT
SEP 22

The Natchaug Amateur Radio Association will sponsor its annual giant flea market on Sunday, September 22, 1985, from 9:00 am to 4:00 pm, at the Elks home, 198 Pleasant Street, off Rt. #32, Willimantic CT. Admission is $2.00. Children under 16 will be admitted free. Advance reserved tables inside or outside will cost $5.00 each; at the door they will cost $7.00. There will be ham gear, CB, audio, parts, surplus items, computers, plus much more. There will be food and drinks. Talk-in frequencies will be .52 direct and 147.30/.90. For information, please contact Ed Sadeski KA1HR, 49 Circle Drive, Willimantic CT 06226; (203)-456-7029 after 4:00 pm.

WICHITA KS
SEP 22

The Wichita Amateur Radio Club will sponsor its annual hamfest on September 22, 1985, at Camp Hiawatha, 1701 West 51st Street North, Wichita KS. There will be a flea market, programs, and commercial exhibits. For further information, contact Gary Vreeland NDØT, 1920 S. Santa Fe, Wichita KS 67211.

ATLANTA GA
SEP 27-29

DXPO 1985 will be held on September 27-29, 1985, at the Lanier Plaza Hotel, I-85 and Monroe Drive NE, Atlanta GA. Registration will be $49.50. Some of the premier attractions will be: John Devoldere ON4UN, holder of 5BWAZ #1 and author of several books; Rusty Epps W6OAT of the recent FOØXX Clipperton DXpedition, and the first presentation of Carl and Martha Henson's expedition to 3C1. For information or reservations, contact Grover Meinert KC4BX, 720 Starlight Lane NE, Atlanta GA 30342.

ELMIRA NY
SEP 28

The Elmira Amateur Radio Association will sponsor the tenth annual Elmira International Hamfest at the Chemung County Fairgrounds on September 28, 1985. Gates will open at 6:00 am and the hamfest will continue until 5:00 pm. Tickets will be available at the gate, or in advance from Steve Zolksky, 118 East 8th Street, Elmira Heights NY 14903. Among the day's activities will be an outdoor flea market, indoor dealer displays of new equipment, and breakfast and lunch served on the premises. For further information, contact Don Estus, 42 Maplehurst Park, Horseheads NY 14845; (607)-739-4807.

ANNISTON AL
SEP 28

The annual Anniston Hamfest will be held on Saturday, September 28, 1985, at the Anniston National Guard Armory, from 8:00 am to 3:00 pm. Admission and parking will be free. Coffee and doughnuts will be free until 8:30 am. All tables are indoors and are $5.00 each. FCC exams will be administered. Talk-in on 147.64/.04. For further information, contact Jim Vice, Route 1, Box 462, Alexandria AL 36250; (205)-820-0638.

SANTA FE NM
SEP 28-29

The Northern New Mexico ARC will sponsor the Northern New Mexico Hamfest on Saturday and Sunday, September 28-29, 1985, at the all-weather facilities of Camp Stoney, 8 miles east of Santa Fe NM. Licensing exams will be held on Saturday morning and the aspencade color tour will be held on Saturday afternoon. Free overnight camping is available (no hookups). From 8:00 am to 3:00 pm on Sunday will be the tailgate flea market and dealer displays. A hot dog lunch is included in the admission price: $3.75 for adults and $1.75 for children. Talk-in on .52 and local repeaters. For more information, send an SASE to NNMARC, Route 3, Box 95-15, Santa Fe NM 87501.

GRAYSLAKE IL
SEP 28-29

The Chicago FM Club will sponsor Radio Expo 85 on Saturday and Sunday, September 28-29, 1985, beginning at 9:00 am, at the Lake County Fairgrounds, Routes 120 and 45, Grayslake IL. The flea market will open at 6:00 am. Admission (good for both days) is $3.00 in advance; $4.00 at the gate. Reserved indoor flea-market tables are $5.00 per day; electricity is $3.00 per day. Features include displays by manufacturers, seminars, technical talks, and alternate activities. There will be free parking and overnight camping. Talk-in on 146.16/.78. For advance tickets, table reservations, or more information, send an SASE to Radio Expo 85, Box 1532, Evanston IL 60204; (312)-582-6923.

SUTTON NH
SEP 29

The Connecticut Valley FM Association will hold its 9th annual hamfest and flea market on September 29, 1985, at King Ridge Ski Area in Sutton NH, from 9:00 am to 5:00 pm. General admission will be $2.00; dealer and flea-market setup will be $3.00. Food will be available on the premises. Overnight camping will be available for self-contained units only (no hookups). Take Exit 11 off I-89. Talk-in on 146.76 or 146.52 simplex. For more information, contact Francis Callahan KA1BWE, PO Box 173, East Wallingford VT 05742.

LOUISVILLE KY
OCT 4-6

The 1985 National ARRL Convention will be held on October 4-6, 1985, at the Kentucky Fair and Exposition Center (Exit 12 off of I-264), Louisville, Kentucky. Admission is $5.00 in advance and $6.00 at the door (12 and under are free). Features include a 200,000-square-foot indoor exhibitors' and flea-market area, ARRL forums, packet radio, AMSAT, FCC, National Weather Service, and alternate activities. For more information, contact the Greater Louisville Hamfest Association, PO Box 34444, Louisville KY 40232; (502)-368-6857.

TORRINGTON CT
OCT 5

The CO Radio Club of Torrington will hold its annual flea market on Saturday, October 5, 1985, from 9:00 am to 3:00 pm, at the East Albert Street Recreation Building, Torrington CT. Admission is $1.00. Tailgating space is $5.00 and dealer tables are $7.00 each. Talk-in on 146.955. For more information, contact Donald Taylor KA1GKJ, PO Box 455, Watertown CT 06795.

WARRINGTON PA
OCT 5-6

The Pack Rats of the Mt. Airy VHF ARC cordially invite all amateurs and friends to the 9th annual Mid-Atlantic VHF Conference on Saturday, October 5, 1985, at the Warrington Motor Lodge, Route 611, Warrington PA, and our 14th Pack Rat Hamarama on Sunday, October 6, 1985, at the Bucks County Drive-In Theater, Route 611, Warrington PA. Admission to the flea market is $5.00, with selling spaces $8.00 each. The gates will open at 6:00 am. Advance registration for the Conference is $4.00. For further information, write to Hamarama 85, PO Box 311, Southampton PA 18966, or call Lee A. Cohen K3MXM at (215)-635-4942.

YONKERS NY
OCT 6

The Yonkers Amateur Radio Club will sponsor its Electronics Fair and Giant Flea Market at the Yonkers Municipal Parking Garage, corner of Nepperhan Avenue and New Main Street, Yonkers NY, on Sunday, October 6, 1985, from 9:00 am to 4:00 pm, rain or shine. Admission will be $3.00 per person, with children under 12 free. For sellers, parking spaces will be $7.00; bring tables. There will be live demonstrations all day long, including amateur radio, computers, mini-theater, satellite TV, CB radio, etc., and a giant auction at 2:00 pm. There will be unlimited free coffee all day, plus free parking. For more information, call (914)-969-1053.

COLUMBIA MD
OCT 6

The Columbia Amateur Radio Association will hold its 9th annual hamfest at the Howard County Fairgrounds (15 miles west of Baltimore, just off I-70 on Route 144, 1 mile west of Route 32) on Sunday, October 6, 1985, from 8:00 am to 3:30 pm. Admission is $3.00 (spouses and children are free). Outdoor tailgating will be $5.00; tables $6.00. Fee for indoor tailgating will be $6.00 if received by September 30 and $8.00 after September 30. Food will be available. Talk-in on 147.735/.135 and 146.52. For table reservations or information, write Mike Vore W3CCV, 9098 Lampskin Lane, Columbia MO 21045; (301)-992-4953.

LIMA OH
OCT 13

The Lima Hamfest will be held at the Allen County Fairgrounds, Lima OH, on Sunday, October 13, 1985. Directions: one mile east of I-75, Exit 125A, on Route 309 and Route 117. Advance tickets are $3.00; $3.50 at the door. Tables are $6.00; half tables $3.50. For reservations, send an SASE and check to NOARC, PO Box 211, Lima OH 45802. License exams will be given. For exam information, contact NC8F at the above address.

WIA 75TH ANNIVERSARY

The Wireless Institute of Australia, the world's first radio society, will celebrate its 75th anniversary during 1985. The WIA 75 Award will be available during the period from March 1, 1985, to December 31, 1985. To qualify, amateurs (and SWLs) need to contact (log) 75 members of the WIA. A contact will be valid only if the WIA member's individual membership number is logged. No more than 30 WIA members may be logged in any one callsign area. Send a log extract of the 75 members contacted and $2.00 (Australian) to WIA 75 Award Manager, Wireless Institute of Australia, 412 Brunswick Street, Fitzroy 3065, Victoria, Australia.

HAM HELP

I need a service manual and schematics for a Singer/Gertsch FM-9 service monitor with an FC-3 frequency converter.

Geoff Fors WB6NVH
PO Box 2948
Carmel CA 93921

I need schematics and manuals for a UHF Motorola HT-220 and VHF MT-500. I also would like to contact someone who has converted the MT-500 to the amateur bands.

Ray Lukaszewicz WD6RCL
20610 Alaminos Dr.
Saugus CA 91350

Does anyone have back issues of the *TAP* newsletter for sale or copy? I will gladly pay all costs, including shipping.

Sgt. Al Mulck N5HZG
PO Box 266
Lawton OK 73502-0266

I need a construction/calibration manual (with schematic) for a Sabtronics model 2000 DMM. I will pay copying cost and postage or copy it myself and return original.

John Rusinko
38A Union Ave.
Little Falls NJ 07424

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

For the last few months I have been looking at several simple, that is, cheap, ways to get onto RTTY. As with any other aspect of our hobby, there are all kinds of ways to approach any mode. This allows access for just about any budget. This month's column shall put the cap on that line.

You see, I was leafing through a medical computer catalog (believe me, they have proliferated like new antibiotics since the personal-computer invasion), and I saw a plug and cable listed for more than $25. Now, I knew that I had seen that assembly somewhere else, so I checked a Radio Shack catalog, where I saw the same deal for one-quarter the price. While you may get what you pay for, you don't always have to pay as much as you think. Same thing in RTTY—it is not a rich ham's diversion.

The photo this month shows one place to pick up bargains—at a local hamfest. This photo is from the Greater Baltimore Hamboree and Computerfest, sponsored by a local club here in Baltimore, and is representative of many other such gatherings throughout the amateur community. Want to get on radioteletype? Wandering through the aisle one could find an older, very reliable Teletype® machine for twenty to fifty dollars. Any number of stable CW transmitters, the type that was popular with the Novice crowd years ago, were also available. A Globe Chief, Viking, or one of the Heath series is almost always around, often for a song. Add a receiver, unless you have one (you are a ham, aren't you?), and you could be on RTTY for under a hundred bucks! Rich man's hobby? Like fun!

To get that transmitter on FSK, you could use the AFSK circuit published here two months ago, if it is a stable, well-filtered sideband rig. However, the older CW-only transmitter run by an internal or external vfo (variable frequency oscillator) requires a different tack. My favorite version of the venerable shift-pot circuit is shown in Fig. 1. This simple little circuit remains the quickest way to get a transmitter onto FSK and still costs only a few dollars, even if you have to buy all the parts!

Oh, when you go looking for machines, you may be confused by the designations given to them. The most popular teleprinters were produced by the Teletype Corporation and bear a numerical model number as their identifying name. To help you out, the Model 12 is the earliest machine you are likely to see. It is an old workhorse, is limited to 45.45 baud (also called 60 words per minute or 60 speed), and like all of the "five-level" machines I will mention, uses a five-bit Murray code, with one start and 1.42 stop bits. The Model 15 page printer is the most common printer seen and can run 75 speed with the proper gearing. The next most popular configuration combines a Model 15 page printer with a Model 14 reperforator and transmitting distributor and calls the whole gemisch a Model 19. Next up the line is the Model 28, which is an integrated unit capable of communicating at 100 wpm, along with 60 and 75. The most modern Murray machine you are likely to see is the Model 32, which is the Murray version of the popular ASCII Model 33 machine. I will also note that there is a light-duty machine, the Model 26, which will occasionally surface, but most amateurs tend to avoid it like the plague.

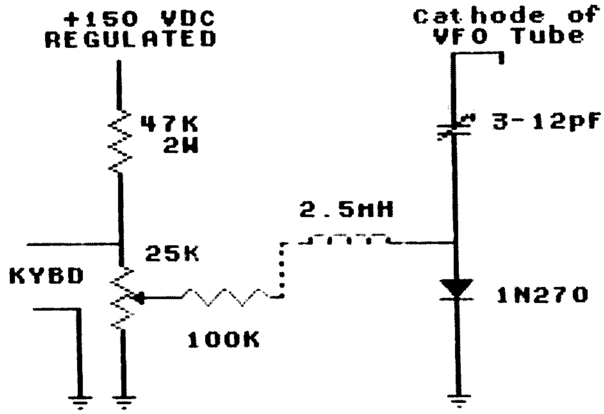


Fig. 1. Shift-pot RTTY transmit circuit.

Teletype machines that use the ASCII character set that are likely to pop up on the surplus market are the Models 33 and 35. The Model 33 is the common computer workhorse, sort of the Model 15 of the computer set, and is seen in a variety of interfacing configurations. The Model 35 is an ASCII version of the Model 28 and is just as reliable. Both of these machines are normally configured as 110-baud 7-bit ASCII machines, with one start and one stop bit.

I am often hesitant to recommend, or even mention, commercial enterprises and outlets for RTTY equipment. However, several readers have passed along one name, so I shall pass it to you, with my usual *caveat emptor*. For many years, Typetronics, in Ft. Lauderdale, Florida, has been a source for hard-to-get RTTY parts. Ranging from complete printers to levers, gears, and cogs, all the way to manuals, it would seem that this is one place to at least investigate. I have not seen a catalog in quite a while, so I don't know what's new there, but for those of you who have been asking where to get a keytop or function lever, this may just be the place. Drop them a note at Typetronics, Box 8873, Ft. Lauderdale, Florida 33310, and be sure to tell them that you read about them in "RTTY Loop."

As always, I have been enjoying your letters and E-Mail, via CompuServe, over the past month. I have been trying to get better at answering each and every one as soon as possible. If you have sent me a question on CompuServe, you should have a reply within a few days. Letters take me a bit longer, but if more than a month has elapsed, one of three things has happened: You did not send in a self-addressed stamped envelope, the postal service screwed up on one side or the other, or I am holding the letter for more information or assistance. Send another note if you think it's been too long—there's always the outside chance that the dreaded fourth possibility has taken place—your letter is lost on my desk! Once again, send your letter to the address above, or E-Mail on CompuServe to me at ppn 75036,2501.

Yes, the reprint series is alive and well. There are now seven or eight in the series, with more being added when I get the time. Feel free to send a self-addressed stamped envelope for the latest list, even if you have requested one before—I know it changes!

Your input on various computer RTTY programs has been most gratifying. We will start next month with a review of all you have related on one computer type and move on monthly to cover them all. No, what I say will not be cast in concrete, so if you disagree with the findings related, let us hear from you, we will all benefit. What's that you say, which computer will we cover first? Well, the answer is obvious from previous columns, I think, but if you can't figure it out, I guess you will have to wait for the next issue of *73* and find the answer right here in "RTTY Loop."

The outside flea-market area at the Greater Baltimore Hamboree and Computerfest.

FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

SOLID-STATE STICKLERS

It's hard to believe how solid-state devices have changed our way of life. I'm writing this column on a microprocessor-driven computer while listening to a transistorized radio. My office has an LED-type clock and a microprocessor-equipped printer, answering machine, television, calculator, and telephone. After I finish writing for the day, I'll probably go for a spin in my car, which features a solid-state ignition system and its own on-board microprocessor that controls the vehicle's performance and fuel economy.

As I explained last month, when I first got into ham radio, tubes were everywhere. Today, you can't find a rig of any sort that doesn't come chock-full of mysterious little black and silver blocks with dozens of mysterious, silver- or gold-plated leads. Of course, you also can't find a rig of any sort that was built in America. But that, as they say, is another story.

Anyway, with solid-state components dominating our hobby and lives to the extent they do, it's about time "Fun!" devoted a column to these devices. Here goes.

ELEMENT 1
MULTIPLE CHOICE

1) In a TTL-type circuit, the multiple-diode cluster of the diode-transistor logic circuit is replaced by a:
1) tube
2) multiple-emitter transistor
3) single-emitter transistor
4) grounded-emitter transistor

2) A silicon-controlled rectifier is also known as a:
1) CPU
2) logic chip
3) triac
4) thyristor

3) Which of the following is *not* a liquid-crystal type?
1) nematic liquid-crystal
2) smectic liquid-crystal
3) isotropic liquid-crystal
4) calcified liquid-crystal

4) How many bits of memory does a 16-bit memory chip *really* have?
1) 16,000 bits
2) 15,884 bits
3) 16,384 bits
4) 16,281 bits

5) Selenium rectifiers were first developed around:

1) 1880
2) 1910
3) 1930
4) 1950

ELEMENT 2 TRUE-FALSE

		True	False
1)	A zincita detector was an early kind of semiconductor diode.	____	____
2)	An LED is a type of transistor.	____	____
3)	Field-effect transistors were developed before bipolar transistors.	____	____
4)	TTL chips require a 12-volt power supply.	____	____
5)	CMOS RAM is usually nonvolatile	____	____
6)	Flip-flops are logic devices.	____	____
7)	Linear ICs are digital devices.	____	____
8)	Blue LEDs are fairly common	____	____
9)	A klystron is a type of microwave transistor.	____	____
10)	Tin is a semiconductor material	____	____

ELEMENT 3 MATCHING

Match the solid-state device in Column A with the description in Column B.

Column A	Column B
1) 6502	A) Small-signal PNP transistor
2) 1N34A	B) Large-signal PNP transistor
3) 2N1491	C) Motorola 16-bit microprocessor
4) 2N5461	D) Small-signal NPN transistor
5) 68000	E) IGFET
6) 2N406	F) MOSFET
7) 40600	G) Motorola 8-bit microprocessor
8) 2N441	H) Semiconductor diode
9) MPF122	I) P JFET
10) 2N706A	J) N dual-gate FET
	K) Large-signal NPN transistor

ELEMENT 4 FILL IN THE BLANK

1) CMOS stands for ______metal-oxide semiconductor.
2) PROM stands for ______read-only memory.
3) An avalanche diode is used at ______ frequencies.
4) The region in a semiconductor that has an abnormally high resistance level is called the ______layer.
5) The development of a transverse electric field in semiconductor material is called the ______effect.

THE ANSWERS

Element 1:
1—2, 2—4, 3—4, 4—3, 5—3.

Element 2:

1—True	A crystal detector.
2—False	Diode, as in light-emitting diode.
3—False	It's the other way around.
4—False	Five volts.
5—True	That's why it's often used in portable computers.
6—True	Used as counting devices in computers.
7—False	They respond to analog signals.
8—False	They are difficult and expensive to make.
9—False	A klystron is a tube.
10—True	Along with selenium, boron, germanium, and other elements.

Element 3:
1—G, 2—H, 3—K, 4—I, 5—C, 6—A, 7—J, 8—B, 9—F, 10—D.

Element 4:
1—complementary
2—programmable
3—microwave
4—barrier
5—Hall

SCORING

Element 1:
Five points for each correct answer.
Element 2:
Two and one-half points for each correct answer.
Element 3:
Two and one-half points for each correct answer.
Element 4:
Five points for each correct answer.

How did you do?

1-20 points	Your brain is probably solid-state
21-40 points	Hooray for the age of tubes
41-60 points	Have built a code-oscillator kit
61-80 points	Replaced your CRT with an LCD
81-100 points	Cold to the touch

BE MY GUEST

Guest Editorial by Bill Pasternak WA6ITF

HIDING BEHIND 20 KHZ

If the League's Board of Directors had ever envisioned the furor that their endorsement of a 2-meter repeater band plan has brought about, I doubt if they would ever have given the plan their blessing. But hindsight is wonderful, and what's done is done.

In a way, the Board did those involved in the coordination of 2-meter repeaters a favor. For years, there had been a definite adversarial relationship between the proponents of two different forms of 15-kHz plans, but thanks to the ARRL Board, there was a new official kid on the block. He was born in 1978 in Seattle, Washington, and nobody gave him the slightest chance of survival if he ventured away from this retreat surrounded by the Cascade Mountains. But the kid did escape. First he went east to Michigan, then south to Texas and Alabama. Now he has put his two cent's worth into the way things are done in western Pennsylvania and Georgia. Rumor has it that he is also heading west to Hawaii. Well, the kid is making a bit of a name for himself, but in the process he is giving the 15-kHz folks a chance to evade the real issue: How many repeaters is enough on 2 meters?

The 20-kHz issue came at just the right time. So much attention is being paid to it that little attention is going elsewhere. After all, this 20-kHz thing is a threat to the status quo! We can't have that.

In the big cities there are more useless and unused "ego boxes" per square inch than can be found anywhere else in the world. According to the ARRL, there are now almost 6000 repeaters operational on 2 meters. Not paper boxes, but repeaters with actual hardware that goes "ker-chunk" in the night. Thats a heck of a lot of repeaters for any one band and in any one country! And, you might think that 6000 would be enough, right? Wrong! If trends continue, we could hit the 7000 mark within a year or two. The question is, do we want to have 7000 repeaters on two meters? Is it a record we can be proud of, or one that shows our inability to be efficient in the use of spectrum for interference-free communication? Surely, 4, 5, or 6 machines all on the same channel and serving the same geographic and demographic area cannot be said to be providing interference-free service!

So, coordinators out there in toyland, keep playing your silly game as though it really had meaning. Keep up the facade of being riled about the 20-kHz schism. It's the best excuse yet for not solving your problem of overcrowding that was brought your way by submitting your will to the ego of others. Keep looking for nooks and crannies in which to put yet another "ego box." You may be able to keep running from the inevitable for another few weeks or months, but one of these days you will have to say, "No! We have no more room!" Then what? Will you have the fortitude to do it, or will you simply steal away into the night like so many before you? 15 kHz versus 20 kHz isn't the real question. Doing what's needed is, even if it means saying, "No" to your closest friend. Only then will frequency coordination of repeaters have any meaning in amateur radio.

Bill Pasternak WA6ITF is the Network Director for Westlink *and a frequent contributor to* 73.

LETTERS

TVI TERMINATED

To Bradley Wells KR7L

I wanted you to know that your article ("Wrap Up TVI," November, 1984) helped solve a very troublesome TVI problem that began when a next-door neighbor installed a new TV antenna which used a coaxial transmission line.

Low-pass and high-pass filters cut the interface down to a minor herringbone effect when I operated on 20 meters but were of no help in correcting a front-end overload problem when I transmitted on 40 meters.

I suspected my vertical antenna, so I erected a dipole under the eaves of my house, some 60 feet from the receiving antenna, and with my entire house between the dipole and the TV system. The blanking persisted.

Today I installed an rf choke made from a discarded TV yoke and several turns of coax as your article suggests. The neighbor now reports minimal to no interference regardless of which antenna I use for transmitting!

Incidentally, I've never had a bit of trouble with any of the four TV receivers used in my house, all of which are fed with 300-Ohm line.

Cart Steavenson K6WZ
Sylmar CA

LADDER-LINE LOVER

I very much enjoyed "So Why Do They Call It Wireless?" in the March, 1985, issue. I have been using this antenna and preaching its virtues ever since reading "The Easy Way" by WB5IIR two years ago. Surprisingly, I have encountered considerable hostility to the idea and on occasion have been dismissed with comments like, "why don't you just use coax like everyone else?" or "tuners are no good."

The article's breakdown of wavelength multiples for 10, 15, 20, and 40 meters when feeding an 80-meter half-wave dipole is correct except for that oddball ham band, 15 meters (which is really only 14 meters long). For an antenna length of 126 feet, a 21.225-MHz signal is about 2.7 wavelengths, not 3 wavelengths. That happens because 15 meters is an odd multiple of the others, a delightful fact which allows us to feed a 15-meter signal to a 40-meter dipole through low-impedance coax. But the real magic happens when we change to high-impedance feedline, for then we can feed all signals to one antenna.

In my installation I have avoided using an antenna length which is resonant on any of the ham bands, not because I don't like the very low feedpoint impedance at the primary frequency, but because I don't like the very high feedpoint impedance at even multiples of the primary. For example, a 66-foot centerfed dipole offers less than 100 Ohms of feedpoint impedance to a 40-meter or 15-meter signal, but 5,000 to 10,000 Ohms to a 20-meter or 10-meter signal. By cutting my antenna away from resonance, I only have to deal with feedpoint impedances of about 1,000 or so Ohms, which my twinlead and simple tuner can easily handle. How far away? A few feet will do. The only concern is to avoid even multiples of 8 feet or 11 feet in order to avoid high feedpoint impedances on some frequencies. As always, odd multiples are okay.

Any antenna longer than ¼ wavelength can be made to resonate with acceptable efficiency, so I have chosen 70 feet for my QTH. That length is just a little longer than ¼ wavelength of 80 meters, is not an even multiple of 8 or 11 feet, fits between two trees, and has provided me with excellent contacts on 10 through 80 meters. Similarly, 38 feet would work nicely on 10 through 80 meters in situations where 70 feet isn't practical. A big bonus is that MARS and CAPS signals can be transmitted by those so authorized, and the plea-

sures of shortwave listening are greatly increased by using a tuned antenna.

Scott H. Katcher KF4FJ
Miami FL

160-METER MIDGET

Since publication of my article describing a horizontal loop antenna for 40 meters ("A Space-Saver Seven Megger," January, 1985, page 44), I have discovered that the antenna will work on 160 meters. I believe that the coax transmission line transforms the impedance of the loop at about 1850 kHz to approximately 50 Ohms. I conducted an experiment in which I measured the vswr (voltage-standing-wave ratio) of the antenna at the transmitter end of the transmission line, first with the original transmission line which is about 50 feet long, and again with an additional 40 feet of transmission line added.

The antenna is rather narrowbanded and the addition of 40 feet of transmission line reduced the minimum vswr from 1.2:1 to 1.0:1 and supports my theory that the transmission line is indeed acting to change the impedance of the loop to a value of about 50 Ohms.

This is definitely not a DX antenna, but from my Ohio location I have worked a number of stations in the recent 160-meter contests. Several of these stations were as far away as Florida and Oklahoma—not too bad for a midget 160-meter antenna, most of which is only about eight feet off the ground!

H. H. Hunter W8TYX
Columbus OH

FIELD DAY '85

The subject of Field Day came up at the weekly meeting of the Friday Amateur Radio Technical Society (FARTS). I suppose it doesn't make any difference who brought it up, but it sure caused a lot of stares in the Beaver Brook Yacht Club (alias Mac's Place) in Keene, New Hampshire.

After much discussion, the majority of the membership decided it was time for another maximum (or was it minimum?) effort. Since there were no volunteers to chair the Field Day Committee, the membership, in its truly democratic way, decided that the officers should run the effort. Oops, I should say "officer" because there is only one officer, the president.

"Who's the president this week?" asked Bob K1XR. Nobody could remember, so it was decided to elect a new one. Someone (name withheld to protect the guilty) nominated Jeff WB8BTH, who had not been to a meeting in several weeks. Needless to say, Jeff was elected.

Someone finally got up the nerve to tell Jeff and he looked to the sky and said, "Why me?" After he got over the shock, Jeff started soliciting help over the 147.375 "Keene Machine." He got quite a few suggestions as to what he could do with Field Day, and some were even helpful. Chuck KA1MTM volunteered his 10–80 vertical. I remembered that the site we would use had a pond next to it and if the vertical were mounted on a pipe in the pond, we would have a great ground plane. I mentioned that fact. "You got it, Arnie!" said Jeff. Open mouth, insert foot, chomp, chomp. Now it was my turn to look up at the sky.

During the following weeks (or was it week?), many items were donated/manufactured/repaired/procured for the cause. Antennas built were a 160/80/40-meter dipole and a three-element wire beam for 40 meters. An 80/40-meter dipole was left over from a previous Field Day, so we used it for the Novice/Technician station. A tribander was donated by Larry WB9RRT, as well as a 2-meter Ringo Ranger for packet and 2-meter and 432-MHz beams for OSCAR.

Bright and early (well, maybe not too early for some) Saturday morning, June 22, the effort came together at the Meadowood County Area Fire Department practice site south of Troy NH. There were quite a few surprises that day, some not even ham related. First, when we arrived there were already about 10–15 non-hams there. Ah! Lots of help! Not so. They were there to practice smoke inhalation, at least that was what it looked like to me. Later on, more people in cars drove up honking their horns. Ah! More help! Not so again. A wedding reception was being held in the muster hall. Oh, well.

One very distinctive thing about the practice area is an approximately 50-foot fire tower made up from three power poles, a perfect location for a beam and wire antennas. Luckily, Jeff had asked Bob, a member of the fire department, if the ladder truck could demonstrate its capabilities on Saturday and Sunday.

The ladder truck demonstration allowed Larry WB9RRT, Lennie WA1UNN, Craig N1ACH, and Dave N1BBD a chance to climb the tower in style and mount the tribander, 160/80/40 dipole, and the end support rope of the 40-meter beam.

At the same time, Chuck and I were busy trying to stay dry while mounting the vertical on a 15-foot mast driven in the mud of Bowker Pond. I am happy to say that we accomplished both. The Leaning Tower of Pisa has nothing over our installation.

Once the tower end of the 40-meter-beam rope was secured, Steve KA1MTD and Dave WA1SOZ attached the elements and raised the other end to a flagpole. After this installation was completed, the Novice 80/40 dipole was raised and tuned to the Novice portion of the bands.

Power for this operation was supplied by a 5000-Watt surplus generator, driven by a Crosley 4-banger, and a 3500-Watt Sears generator. Our thanks to Walt WA2VSN and Dale KA1CPZ for the use of the long electrical cables that allowed us to operate away from the noise of the generators.

Dawn K1TOY had volunteered early in the development stages to shop for and transport the food the team might consume in the effort. Sure enough, she showed up with the goodies and was helped in the storage by Kathy KA1MTC and Gerry KA1AKI. And what would we have done without one of our first volunteers, Scott WA1YTW, who handled publicity and bartending. I am able to say that he did very well in one of the two jobs—the most important one, of course.

While the antennas were being assembled and erected, the operating stations were being set up. One station used a Kenwood TS-830, a Ten-Tec 425 amplifier, and a DenTron tuner. This station used the tribander and 160/80/40 dipole antennas. The second station used another Kenwood TS-830 and a Heathkit 221 amplifier. Its antennas consisted of the 40-meter wire beam and the 5-band vertical in the lake. The Novice/Technician station used an ICOM IC-701 and an 80/40-meter trap dipole.

The time had finally arrived: 1559Z, June 22. Everyone was ready... well, almost. Hey Jeff, what callsign are we using?" Oops. We had used W1XU last year, but Jim was unable to attend this year. Nobody volunteered their callsign due to possible greetings from Uncle Charlie. We then noticed that Bob K1XR was not in attendance yet, so the membership voted, and Kilo One X-Rated was on the air.

The first station needed the most electrical power because the Ten-Tec 425 is capable of 1500 Watts out. This station was run by the 5000-Watt generator. The second station and the Novice/Tech station were run with the 3500-Watt generator. There was a bit of trouble getting the big generator started, but once it got going, it was shut down just once during the operation to check the oil. One quart was added and the rig was started again. The 3500-Watt generator was shut down about every 2½ hours for fuel and oil check. Its only problem was not starting after one refueling, but cleaning the spark plug seemed to solve the problem and it ran fine the rest of the time. Both generators ran with about a 5-to-10-volt fluctuation during operation which did not appear to cause any equipment or operating problems.

It was decided not to have a station operating schedule. It appeared to work out very well until the wee hours of the morning when the operator of the second station went to sleep at the switch. I would like to apologize for the continous key-down signal caused by forehead-on-key operation. After mentioning all those who set up, I feel I should also mention those who operated the equipment at one time or another: Jeff WB8BTH, Larry WB9RRT, Arnie N1BAC, Bob K1XR, Craig N1ACH, Bruce WA1YZN, Troy KA1IRV, Parry KW1O, Chuck KA1MTM, Gerry KA1AKI, Dale KA1CPZ, Steve KA1MTD, Dave WA1SOZ, and Dave N1BBD.

What would a Field Day be without visitors? I would like to thank the following for their support and maybe next year we can get them to come and operate also: Joe WB1AMI and XYL, Lem K1IOJ and XYL, Warren WA1RLO (he did help take down the antennas), Snookie KA1DE and son Todd KA1MLV, and lastly, Grahm Brusle, a non-ham, but hopefully not for long.

I would like to give special thanks to Jack Burnett, Frank Cordelle, Dianne Ritson, and Linda Drew of *73* for their special talents. Without them, the cover of this issue and this report would not have come about. Also, thanks to the Meadowood County Area Fire Department for the use of their site and equipment.

It certainly appeared that all had a good time, which is one thing I really enjoy about Field Day. We weren't trying to beat anyone, we were just showing the public that hams are able to operate during difficult situations as well as have fun while doing it.

It appears to me that I should start attending more meetings of the Friday Afternoon Radio Technical Society, especially during the months of April, May, and June. Who knows who the president will be next year.

Arnold "Arnie" Johnson N1BAC
N. Swanzey NH

SATELLITES

USING THE AO-10 APOGEE PREDICTIONS

Apogee predictions for the month of September are provided for three sections of the United States: Washington DC at 39N 77W, Kansas at 39N 95W, and California at 38N 122W. Times are in UTC and apogee in this case is mean anomaly 128 rounded to the nearest whole hour. Use the chart as a guide in aiming your antenna, then fine-tune the azimuth and elevation values to peak the satellite's beacon signal. If you require more accurate orbital predictions, contact AMSAT at PO Box 27, Washington DC 20044.

			WASH		KANSAS		CALIF	
ORBIT	DAY	TIME	AZ	EL	AZ	EL	AZ	EL
1998	1	0100	122	4				
2000	2	0100	120	0				
2001	2	1200					240	2
2003	3	1200					234	4
2005	4	1100					226	11
2007	5	1000			239	2	217	18
2009	6	1000			233	3	211	19
2011	7	0900	239	0	225	11	200	24
2013	8	0800	231	8	216	18	187	27
2015	9	0800	225	9	209	18	181	25
2017	10	0700	216	16	198	23	168	25
2019	11	0600	206	21	186	26	156	23
2021	12	0500	194	26	173	27	144	19
2023	13	0500	188	24	168	23	140	14
2025	14	0400	175	25	155	21	131	9
2027	15	0300	162	24	144	18	122	2
2029	16	0300	157	20	140	13		
2031	17	0200	146	17	131	7		
2033	18	0100	136	12	122	1		
2035	19	0100	132	7				
2037	20	0000	124	1				
2040	21	1100					237	1
2042	22	1000					230	8
2044	23	1000					224	10
2046	24	0900			236	0	215	17
2048	25	0800			229	8	204	22
2050	26	0800	236	0	223	9	198	21
2052	27	0700	229	6	213	16	186	24
2054	28	0600	220	13	203	21	173	25
2056	29	0600	214	14	196	20	167	22
2058	30	0500	204	19	185	23	156	20

BE MY GUEST

What follows is the text of the ARRL's petition to the FCC requesting an expansion of Novice privileges. The Commission has received several petitions covering roughly the same area, and any Notice of Proposed Rule Making (NPRM) that the FCC generates will likely be a synthesis of all of them. However, we feel that the League's proposal embodies the heart of the issue and that the NPRM will contain most of the items requested in this petition. Please read it carefully. A vote against expanded Novice privileges will be a vote against amateur radio. Don't let that happen.—Ed.

RM-5038

The Amateur Radio Relay League, Incorporated (the "League"), the national association of amateur-radio operators licensed by the Commission, hereby respectfully requests that the Commission issue a Notice of Proposed Rule Making looking toward amendment of the Amateur Radio Service Rules (47 C.F.R. Part 97) to enhance the operating privileges of Novice-class amateur-radio operators. In support of this Petition, the League states as follows:

Introduction

The Amateur Radio Service has always been self-reliant in terms of attracting newcomers to its ranks. Commission figures show an influx of 17,392 new Novice licensees from October 1, 1983, through September 28, 1984, comprising the bulk of a total of 18,800 new licensees of all classes during that period. Obviously, the Novice-class amateur license is the first exposure of most newcomers to amateur radio. Unfortunately, the privileges presently available to Novice-class amateurs create a somewhat frustrating experience for many Novices for the reasons discussed below. As a result, a significant number of Novice-class licensees do not maintain their amateur licenses and/or do not upgrade their license class.

Presently, the extent of Novice frequency privileges are 50 kHz at 3.7-3.75 MHz (80 meters), 50 kHz at 7.1-7.15 MHz (40 meters), 100 kHz at 21.1-21.2 MHz (15 meters), and 100 kHz at 28.1-28.2 MHz (10 meters). Morse-code telegraphy is the only operating mode permitted. Even if one is sufficiently interested in Morse-code operation to utilize the full extent of Novice privileges presently available, propagation conditions are now so poor on the two highest-frequency Novice subbands (10 and 15 meters) that, except for local communications, operation is largely limited (and will be so for the next four or five years) to the 40- and 80-meter bands. During the evening hours, the times of greatest amateur activity, the entire 40-meter Novice band is occupied by high-powered international broadcast stations. In the 80-meter band, Novices are faced with increasing competition and interference from Canadian telephony operation below 3750 kHz. Although there are "gaps" which exist between these stations in which experienced telegraphy operators can and do effectively communicate, the same conditions significantly inhibit and frustrate Novice-class licensees.

Given the crowded state of all amateur bands below 21 MHz, and the need to protect privileges that have been earned by holders of the General and higher classes of amateur license, there is little that can be done in these bands to alleviate the difficult conditions facing the Novice radio amateur. Yet, something must be done to increase the attractiveness of this class of license if the Amateur Radio Service is to continue, in future decades, to fulfill its basis and purpose as set forth in the Commission's Rules (47 CFR 97.1). The result is that many Novices lack the incentive to upgrade to a higher class of license, for they have not experienced a sufficient taste of amateur-radio operating to develop a thirst for greater privileges. While Morse-code communication always has been, and no doubt always will be, an important part of amateur radio, it is appropriate even at the beginner level for amateurs to be exposed to other operating modes. (The Commission recognized this when the Novice license was established in 1951, by granting voice operating privileges in the 145-147-MHz band. At the time the Novice license was a one-time, one-year, nonrenewable license, and many Novices who used their voice privileges found that their skills had not developed sufficiently in one year to permit them to upgrade. The privilege was withdrawn on November 22, 1988. Now that the Novice license is renewable, with a ten-year term, this situation no longer applies.) The League's proposal is to provide Novices with voice and data communications privileges sufficient to permit intercommunication with other local amateurs and to provide an occasional opportunity for the long-distance communications that give the Amateur Radio Service its "unique ability to enhance international goodwill." This enhancement of Novice privileges would provide greater motivation for amateurs-to-be to obtain their first license, without reducing the desire to upgrade by attaching too many privileges to what is, and should continue to be, an elementary license. A slight expansion of the syllabus for the Element 2 written examination is also proposed, to encompass basic data communications and voice operating procedures and concepts; the Novice examination would be expanded by ten questions to accommodate the additional material.

The League's Proposal

The first feature of the League's program is to add limited Novice digital communications privileges, to attract young people interested in computers and digital communications to amateur radio. Radioteleprinter and packet-radio privileges on 10 meters, between 28.1 and 28.3 MHz, are proposed, with A1A, J2A, F1B, and J2B emissions (1200 baud maximum). Given the expansion proposed, from 100 to 200 kHz, it is anticipated that a suitable band plan will be developed for the band to keep a large segment free for conventional manual Morse-code operation.

The same band provides an opportunity to permit limited low-power single-sideband operation at 28.3-28.5 MHz. It is anticipated that this would have minimal impact on other licensees. Telephony operation by General-, Advanced- and Extra-class licensees in that segment has not been extensive since the expansion of the telephony subband to include the 28.3-28.5-MHz segment. This is due to the general absence of long-distance propagation on the band since the segment was made available for voice operations less than one year ago. Thus, to permit telephony operation in that segment by Novice licensees would provide a limited, yet significant, enhancement of Novice privileges without inconveniencing other licensees. (This proposal is not unique worldwide. Novices in fifteen countries are permitted to operate telephony on 28 MHz in various segments, at various power levels. These countries include Argentina, Australia, Bolivia, Federal Republic of Germany, Greece, Hungary, Japan, Jordan, Lebanon, Mexico, Netherlands, Papua New Guinea, Spain, Sweden, and Uruguay.) Type A1A, J2A, and J3E emissions in this segment are proposed.

Some limited VHF FM repeater privileges should be accorded so that the large number of Novice licensees can be introduced to and put to use in public-service communications. The League proposes that Novices be permitted use of 220-225 MHz, all voice and data modes (including radiotelegraphy), with a power limit of 25 Watts output. Repeater operation by stations licensed or controlled by Novices would not be permitted. That is to say, a Novice licensee could not sponsor or be the trustee of one. For the same reasons, the League suggests that a portion of the 1240-MHz band, specifically 1246-1260 MHz, be made available to Novices, with a power limit of 5 W. This power limit is proposed so as to avoid concerns relative to rf energy exposure by inexperienced persons. The 1246-1260-MHz segment is proposed as a band which can be allocated with a minimum of delay and a minimum of disruption of existing operation.

The League suggests, at the time the proposed additional privileges are added, that the Element 2 examination syllabus be expanded to include basic digital and voice operating techniques. This is necessary in order that the examination content be commensurate with the privileges granted by the license class. In this connection, it would be proper to expand the Novice written examination to thirty questions and the question pool (PR Bulletin 1035A) to 300, to accommodate additional questions on operational aspects of the additional privileges available to Novice licensees. Present Novice licensees should not be required to submit to reexamination.

The League proposal is not intended to reduce in any way the operating privileges available to General-, Advanced-, and Extra-class licensees. Presently, Section 97.67(d) limits all licensees' operating power to 200 Watts PEP output when operating in Novice subbands. Given the relative absence of General-, Advanced-, and Extra-class operation on those frequencies, and because the instant proposal would allow Novice privileges on additional frequencies on which higher-class licensees have been permitted full-power operation, modification of Section 97.67(d) is proposed. Specifically, it is suggested that Novice-class licensees be permitted to operate on HF frequencies available to them at 200 Watts PEP output, 25 Watts at 220-225 MHz, and 5 Watts at 1246-1260 MHz. Other licensees would be permitted to operate at power levels permitted by their class of license. For other than Technician-class licensees, it is not proposed to continue to limit power of higher-class licensees when operating within Novice subbands.

With the additional privileges proposed, the Novice-class amateur license would become more attractive to newcomers to amateur radio, and more importantly, it would provide sufficient diversity of operating privileges to provide the entry-level licensee with an incentive to upgrade his or her license class and remain involved with amateur radio.

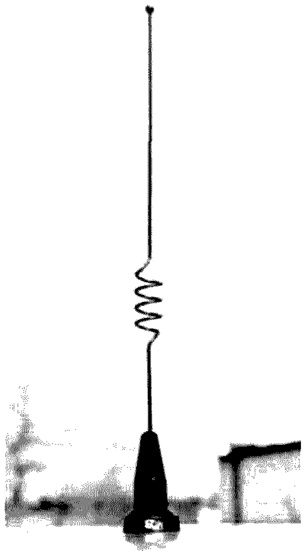
Wherefore, the American Radio Relay League respectfully requests that the Commission institute rulemaking proceedings at an early date looking toward modification of the Amateur Radio Service rules to expand operating privileges available to Novice-class licensees in the Amateur Radio Service.

NEW PRODUCTS

TEFLON™-CLAD ANTENNAS

Two new mobile antennas designed for cellular applications have been introduced by The Antenna Specialists Co. The new antennas feature black Teflon S-coated whips and adapters which provide additional protection for high-corrosion localities.

Model ASPD1860 is the Teflon S-coated version of the company's Model ASPD1850 standard roof mount. The 3-dB-gain antenna is furnished with a positive male/female rf connection at the antenna base and 17 feet of A/S low-loss PRO-FLEX™ cable.



Antenna Specialists' ASPD1860 cellular roof-mounted antenna.

Model ASPRD911 is the black, Teflon S-coated, deck-mounted, elevated-feed antenna. The stanchion assembly and base also are black. Exhibiting 3 dB gain, the antenna covers the entire cellular spectrum without cutting or tuning. It requires no ground plane and therefore is especially appropriate for vehicles with fiberglass bodies. The antenna terminates with a female N connector and is supplied without cable.

For further information, contact *Marketing Department, The Antenna Specialists Co., 12435 Euclid Avenue, Cleveland OH 44106.*

BV ENGINEERING ANALYSIS SOFTWARE

BVE's LOCIPRO software provides control-system and electronic engineers a simple means to quickly determine closed-loop system stability from open-loop transfer functions. LOCIPRO is a stand-alone computer program which quickly solves the locus of roots for systems up to 26th order and with ten loop elements. Output data can be vectored to a line printer or to a data file. All program inputs are free-format and menu-driven. All output files are compatible with other BVE programs, so you may add transient analysis and high-resolution graphics. LOCIPRO is available under MS-DOS, CP/M-80, and TRSDOS in 121 different disk formats.

For additional information and a free catalog, write *BV Engineering, 2200 Business Way #207, Riverside CA 92501.*

CMC COMMUNICATIONS DOCKING BOOSTERS

A new series of power boosters for hand-helds is now available from CMC Communications. The "Docking Booster" combines a 30-Watt power amplifier and a 16-dB-gain GaAsFET preamplifier to extend the range of your Kenwood, Yaesu, ICOM, or Standard HT. The Docking Booster is mounted on a convenient bracket that fits on most car doors and incorporates the amplifiers, a microphone clip, dc cabling, and a UHF external antenna connector. Separate models are available for 2m and 70-cm handie-talkies.

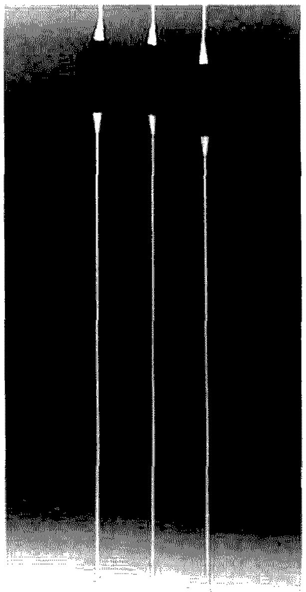
For complete details, contact *CMC Communications, Inc., 5479 Jetport Industrial Blvd., Tampa FL 33614; (813)-885-3996.*

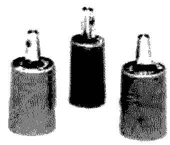
CMC's Docking Booster for HTs.

LARSEN DUAL-BAND MOBILE ANTENNAS

Larsen has announced a series of dual-band mobile antennas for the 2m and 70-cm amateur bands. The new design incorporates a half-wave element for 144-148 MHz and collinear elements for 440-450 MHz. The single antenna thus conveniently works on both bands. The self-resonating design doesn't require a ground plane, so the antenna is ideal for use in mobile and base applications using standard Larsen BSA-K hardware.

For complete details, contact *Larsen Electronics, PO Box 1799, Vancouver WA 98688; (206)-573-2722.*





Dual-band antennas from Larsen.

ALPHA DELTA TWIN-SLOPER ANTENNA

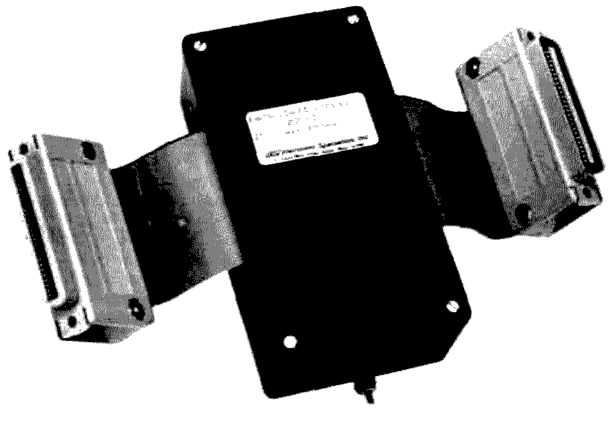
Alpha Delta Communications is now offering the DX-A twin-sloper antenna. Operating on 160, 80, and 40 meters, the antenna uses a tower or downlead as the counterpoise. One side of the antenna (33 feet long) operates on 40 meters, and the other side (80 feet long) is for 80 and 160 meters. The 80/160 leg is broken by an Iso-Res isolator/resonator coil (an rf choke) to provide the dual-band capability. The DX-A exhibits excellent low-angle radiation and can easily handle high power. The antenna comes complete with stainless-steel hardware, insulators, and support rope.

For more details, contact *Alpha Delta Communications, Inc., PO Box 571, Centerville OH 45459.*

PDS-21 TELEPHONE SECURITY SYSTEM

Electronic Specialists' product line now includes the Kleen Line PDS-21 secondary telephone security system. Commonly used for office and factory installations, the PDS-21 suppresses transient voltage spikes and filters against rf interference. Special models tailored for telephone, data, or remote-control applications may be ordered. One through twenty-five pairs may be accommodated.

For more information, contact *Electronic Specialists, Inc., 171 S. Main Street, PO Box 389, Natick MA 01760; (800)-225-4876.*



The PDS-21 telephone security system by ESP.

MIDLAND MOBILE

Midland Land Mobile Radio has announced a new four-channel UHF portable FM radio. The model 70-252B covers 450-470 MHz, with an output of 5 Watts. The radio is 6-13/16" high, 2-3/8" wide, 1-5/8" deep, and weighs approximately 24 ounces when equipped with a battery pack and helical antenna. The model 70-252B comes with a 500-mAh battery pack and an earphone jack. Available options

Midland LMR's model 70-252B UHF portable radio.

include tone-coded squelch, an earphone, a vehicular charger, and a one-, two-, or eight-unit desktop charger.

For complete details on Midland LMR's model 70-252B, contact *Midland LMR, Marketing Department, 1690 N. Topping, Kansas City MO 64120.*

ASD SOLDERING GUN

American Soldering Devices Corporation has announced their new model WG-1400 soldering gun. The WG-1400 features a dual-position trigger switch for high (140 Watts) and low (100 Watts) heat settings and a built-in spotlight to provide work-piece illumination. The heavy-duty tip may be readily tinned for soldering, or used dry for working with thermoset plastics.

For further information, contact *ASD Corporation, PO Box 24, Shirley NY 11967.*

AEA ATU-1000

Advanced Electronic Applications has announced the ATU-1000 Advanced Terminal Unit. The ATU-1000 combines Morse, Baudot, ASCII, packet, and AMTOR for complete HF RTTY operation. Both mark and space tones may be adjusted independently from 1000 to 3000 Hz, providing compatibility with all commercial and amateur tone pairs. For fixed-pair operation, an optional eight-pole bandpass pre-filter is selectable from the front panel. The CW filter is adjustable from 700 to 2500 Hz. Received-signal tuning is indicated by a discriminator-style LED bar graph with a selectable mark-only, space-only, and summed-mark-and-space display. A front-panel frequency counter shows the input mark-filter center frequency, the space-filter center frequency, the AFSK-generator mark or space frequency, or the frequency of the incoming signal. I/O may be accomplished via TTL, RS-232C, or current loop.

For more details on the ATU-1000, contact *AEA, PO Box C-2160, Lynnwood WA 98036; (206)-775-7373.*

The ATU-1000 from AEA.

HAMTRONICS PACKET AMPLIFIER

Hamtronics has announced a version of their 220-MHz power amplifier designed specifically for packet-radio use. Called the PPA-220, the new amplifier is similar to the Hamtronics LPA 2-40 but features increased gain (up to 50 Watts out with 2 Watts in) and a built-in PIN-diode antenna switch to limit T/R switching to only a few milliseconds. With its ultra-fast T/R switching, the PPA-220 is an ideal amplifier for inter-area 9600-baud packet relay stations.

For more information about this and other Hamtronics products, write or call *Hamtronics, Inc., 65 Moul Road, Hilton NY 14468-9535; (716)-392-9430.*

HEATHKIT HD-4040 TNC

The HD-4040 Terminal Node Controller (TNC) has been added to the amateur-radio product lineup at Heath Company. The HD-4040 is a version of the popular Tucson Amateur Packet Radio (TAPR) TNC which allows communication using terminal or computer control of any amateur-radio system. Packet radio ensures error-free communication and greatly increases communication speed. The HD-4040 has a built-in 1200-baud modem, and baud rates of up to 9600 are possible with an external modem. Both AX.25 and VADCG protocols are supported.

Three modes of operation are provided: a conversation mode which allows communication with another operator, a command mode which allows configuration of the TNC and the use of a variety of operating commands, and a transparent mode which is used when transferring files from one computer to another. A built-in beacon can be set to transmit a message at designated intervals.

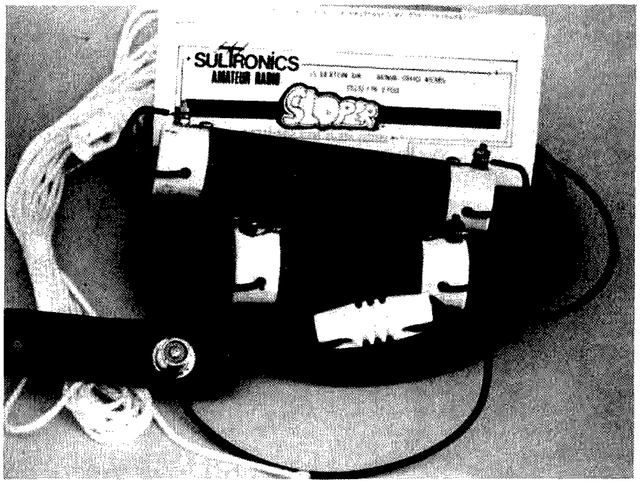
For more information about the HD-4040 TNC and a free catalog of Heath products, contact *Heath Company, Dept. 150-525, Benton Harbor MI 49022.* In Canada, write *Heath Company, 1020 Islington Avenue, Suite 3100, Toronto, Ontario M8Z 5Z3.*

SULTRONICS HF SLOPER

Sultronics Amateur Radio has introduced their HF Sloper series antennas for 160, 80, and 40 meters. The SS-2A Duoband Sloper, which is only 45 feet long, covers 80 and 40 meters, and the 60-foot SS-3A Triband Sloper handles 160, 80, and 40 meters.

Both models are trapless and feature a 50-Ohm coaxial feed, #12 solid copper wire, and a heavy-duty aluminum mounting bracket. The inherently low angle of radiation makes these models ideal for DX work when only a small antenna is appropriate, and both the SS-2A and SS-3A are useful for general-coverage SWLing.

For more details, contact *Sultronics Amateur Radio, 1587 US 68 North, Xenia OH 45385.*



The SS-3A Triband Sloper from Sultronics.

REVIEW

MFJ'S PORTABLE ANTENNA AND ANTENNA BRIDGE

Every active ham I've ever known has, at one time or another, found himself or herself in a real pickle concerning a suitable antenna. No, I don't mean at the home station usually (but it has happened there, too); what I'm getting at is the portable situation in a hotel room, a motel, at a vacation site, or even "hilltopping" in the car.

Let's take a f'rinstance that happened to me recently. I was forcibly ejected from my "shack" (the spare bedroom) because of some house guests...and I wanted to listen to my R-71A...but no antenna! Sure, I could have strung up a random wire over the picture frames, the doors, window sills, and a lamp shade or two ...and believe me I've done that before...but this time I decided to go the elegant route. Why did I choose to call it elegant? Bear with me a minute or two.

A few weeks ago, I ordered the MFJ-1621 Portable Antenna from MFJ Enterprises out there in Mississippi. It had arrived but I hadn't got around to trying it yet. It's really a *transmitting* antenna, unlike many of the so-called portable antennas you'll find here and there. It consists of a 54-inch telescoping whip mounted on a small black phenolic case that contains a built-in antenna tuner and a field-strength meter, *plus* 50 feet of coax *and* a PL-259 connector!

All I had to do was tighten two setscrews on the whip to hold it securely on a stud that projects from the top of the box. Well, since I didn't plan to transmit at this particular time, there was no need to slip the clear plastic tube over the extended antenna. (This is a safety feature provided to protect the operator when the antenna is being used as a transmitting antenna and is hot with rf, and it comes with the antenna.)

Receiving

To make a long story short, I quickly extended the antenna, connected it to the box, and plugged the coax connector into my ICOM R-71A general-coverage receiver. Voilà! This antenna covers only the 40-, 30-, 20-, 15-, and 10-meter amateur bands and I wasn't able to listen to the AMers on 75...but that didn't matter. I was in business.

The 40-meter band has several switch positions and, of course, a variable capacitor so that the entire band can be tuned and the antenna matched to frequency. By careful adjustment I was able to bring in stations throughout the entire range—and with surprisingly good signal strength, too.

There was no difference in the ease of tuning and matching on the other bands, either, and good signals were heard, even on 10 meters (somewhat of a rarity these days considering the state of the ionosphere and the MUF). You'll be interested to hear that there is considerable overlap, and that frequencies somewhat above and below the amateur bands can be tuned in easily.

You wouldn't expect the performance of a full-size outdoor antenna and neither did I, but I was absolutely pleased with what I did hear, and that included a lot of DX stations.

Transmitting

After the company had gone and I was back in my shack, I thought it might be appropriate to try the 1621 as an indoor antenna for transmitting, so I slipped the plastic sleeve over the metal whip and hooked up my transceiver.

Now here's where another MFJ device works really great—the MFJ-204 Antenna Noise Bridge. The bridge has a meter, a frequency-tuning capacitor and range switch, a resistance/impedance control, and provisions for either an internal battery or a battery eliminator so that it can be used on 115 V ac. Normally, you use the bridge by listening to the signal output on an accurately-calibrated receiver and setting it to the frequency you wish. Then you turn the resistance/impedance control for a meter null and read the antenna feedpoint impedance.

In this case, I wanted to adjust the MFJ Portable Antenna to 50 Ohms on the low end of 40 meters. Simplicity itself. First, I coupled the MFJ Noise Bridge to the receiver antenna-input jack and selected the proper frequency range, varying the frequency control on the bridge until I heard the signal in the receiver at the desired frequency. Next, I set the resistance/impedance control to 50 Ohms. Then I disconnected the bridge from the receiver and connected the coax fitting of the portable antenna to the noise-bridge fitting. The final step was to adjust the controls on the antenna until the noise bridge showed a null. This was so easy to do and so fast that it was done quicker than I can write about it here.

Then I disconnected the antenna coax fitting from the noise bridge and plugged it into the transceiver, firing up the rig on the low end of 40 (yeah, yeah...I'm a CW nut...but you can do the same thing in the phone band if you wish).

Believe it or not, the rig was perfectly matched to the antenna, showing maximum output on the portable antenna's meter, and I managed to work quite a few stations with good signal reports. No, I didn't receive a report that I was pinning the S-meter on somebody's receiver, but I did get a fair share of 579 reports, two 589s and even one 599. Friends, it works!

Being the inquisitive type and not trusting to luck, I repeated the procedure on 20 meters with similar results. As you might expect, the frequency bandwidth on 20 is better than that on 40, so less retuning is necessary as you change frequency up and down the band. This is typical of any antenna, so no problem or unexpected situation here. If anything, stations came back more readily than on 40!

Conclusions

I am very well pleased with both pieces of equipment because they work so well and so quickly. You can carry the MFJ Portable Antenna with you in a suitcase, a briefcase, or a very small box...and the same goes for the MFJ Noise Bridge. Both will fit in an attaché case with room to spare, so there's no excuse for not carrying your transceiver with you wherever you go...because you can be on the air virtually instantly from almost any location.

I forgot to mention the fact that there's a frequency-counter input on the noise bridge, so you'll be able to adjust the frequency accurately if you don't want to use the receiver for the same purpose. The bridge covers a frequency range of at least 160 through 10 meters, so it should be just right for any HF operation you may contemplate. Another great feature is its independence of the power mains, allowing you to take it up to the roof or out to the antenna in the "back 40" without dragging a power cord with you.

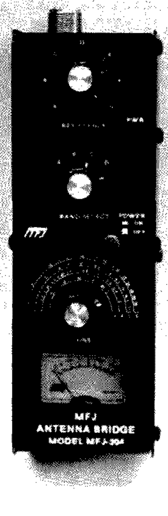
The bridge does not read reactance because to provide that feature MFJ would have had to make it more expensive. However, a resistive reading is all that I needed for my adjustments, and I think that you'll find that the case with your own experiments.

Price and Availability

The MJF-1621 Portable Antenna is available from your dealer or from *MFJ Enterprises, Inc., Box 494, Mississippi State MS 39762*, and the price is $79.95. The MFJ-204 Antenna Bridge also costs $79.95.

Jim Gray W1XU
73 Staff

MFJ-1621 Portable Antenna.



MFJ-204 Antenna Noise Bridge.

BILAL ISOTRON 20

"Why that's just a little feller," said one of my friends when he saw the Bilal Isotron 20 antenna for the first time. Sure enough, it *is* just a "little feller" in size, but its performance belies its appearance. Remember David and Goliath?

Last October, I reported on the Isotron 40 and the excellent results it produced for me on that band. Anticipating a need for a 20-meter antenna to support my desire to have a small, efficient, and easily-erected antenna for use away from home, I asked Ralph Bilal to send me the Isotron 20.

Once again, I wasn't disappointed. The Isotron arrived via UPS in a rugged box with all the components neatly packed and carefully preserved by lots of wrapping material and some rugged plastic envelopes containing the nuts and bolts. Ralph takes the trouble to tape things down inside the box so they won't rattle around, and he includes assembly diagrams and instructions...not just for the antenna that's in the box, but also for the other antennas he makes.

Assembly took only a few minutes, perhaps because of the familiarity I had with the Isotron 40, but probably because it's so simple and has so few parts. Here again is a coil wrapped around a rugged plastic rod, a capacity plate, a smaller tuning plate, an rf chassis connector that mates with your standard PL-259 coax fitting, and a few bits of connecting wire with their solder lugs. Maybe ten minutes at the very most to put it all together...and when you're finished, you have, well, something that doesn't look much like an antenna or anything else you've ever seen, for that matter. My Grandma used to say "pretty is as pretty does," and the Isotron antenna does very well, indeed.

At first, I mounted it on a piece of TV mast tubing (and there is a fitting on the antenna for exactly that kind of mounting) and placed it some 10 feet outside the wall of my house about five feet off the ground. (This was partly due to the fact that I didn't have a longer piece of connecting coax made up and used what I had. Mistake! Even I should have realized that this is the worst possible situation for an antenna—five feet off the ground and shielded by proximity to a house.) It tuned okay—with a bit of fussiness to get resonance, largely because of capacitance-to-ground effects. I had expected miracles, but none were being handed out that day and the antenna disappointed me. (Perhaps I ought to say that I disappointed Ralph by doing something that I knew better than to do.)

The next step was to put the TV mast up on the roof of the house attached to a chimney mount and to run a suitable length of coax to the transceiver. I used

the MFJ Antenna Bridge to make a preliminary tune-up, setting the impedance at 50 Ohms, and found the best setting of the Isotron to be very, very close to this.

Now the antenna began to perform as it should! Stations from all over the world came roaring in (twenty was good that day). Tentatively, I called a CO, not expecting much from this teeny little lump of inductance and capacitance . . . surprise! Right away an answer . . . 589 from southern USA. Then, over the next hour, literally dozens of stations: England, Germany, USSR, France, Canada, Italy, and so on until I tired of the game. Switching between my standard 14AVQ and the Isotron 20, I found as much as two S-units difference and as little as no difference between the two antennas. Typically, when conditions are good, small antennas often perform as well as larger ones. When conditions are poor to marginal, then the larger antenna works best.

However, I should tell you that even though it is a compromise, the Bilal Isotron antenna does work well. You won't ace out any of the Big Gun OX stations, but then you didn't expect to, did you? For a Field Day portable antenna, a vacation antenna, or for a condo or apartment location, you'll find the Bilal antenna a good one. In fact, for the travel trailer or RV owner, I believe it would be nearly ideal. It is inconspicuous, does not look like an antenna (thereby not arousing suspicious neighbors), and does perform. You can cover all of the CW portion of the twenty-meter band or all of the phone portion with two different settings. You must tune it *very* carefully for best match to the 50-Ohm transceiver output, but a little patience here will reward you handsomely.

The Isotron 20 may be obtained through your dealer or direct from the *Bilal Company, S.R. 2, Box 62, Eucha OK 74342*. The price is $49.95 plus $3.50 shipping, packing, and handling charges. If you have any specific questions about this antenna or any of the other Bilal space-saving antennas, you'll find Ralph to be obliging and knowledgeable. Call him at *(303)-687-2837 or (918)-253-4094*.

Jim Gray W1XU
73 Staff

MAIL-ORDER ANNIE

There's a song from my college days written by the late Harry Chapin. It's a tale of a pioneer in the new West who has sent for a mail-order bride. When she steps down from the stagecoach she's far from a beauty, but to the lonely pioneer she's the best thing that ever happened to him. Her name was Annie.

I doubt if Harry Chapin was interested in antenna design, but if he had been, I think he might have written his *Mail-Order Annie* about the antenna-analysis program available from Sonnet Software. It's available for the Apple II series and the Commodore 64.

Contrary to the beliefs of some, inexpensive computers are very powerful when matched with well-written software. The past several years have seen many programs released for amateur-radio applications, but few really put the hardware to the test. Mail-Order Annie does!

Annie might best be described as a simulator. It might not have the same graphic appeal of Flight Simulator, but it allows quite realistic simulations of many different antenna systems and allows for the effects of real ground if desired. The results of the program are a table of figures and a polar graph showing the radiation pattern. Both results can be displayed on the screen or sent to a printer.

Most antenna programs allow little more than the design of dipoles, quads, yagis, and single-element verticals. Annie can analyze an antenna system with a theoretical limit of 65,536 elements! That would make a dandy antenna for the next competition.

Learning to operate Annie will take a while. The menu selections and the accompanying 54-page manual are well designed. This program goes beyond my own knowledge of antenna design, and I had to study the examples carefully. This is a function of my own lack of experience and not a shortcoming in Annie.

The detailed instructions lead you through an analysis of a standard dipole with and without the effects of ground, a sloping dipole, an inverted vee, a 1/4-wave and 5/6-wave vertical, phased verticals, and a 3-element yagi. The results of simulating different antennas can be very dramatic. Without ever walking outside you can try out various configurations and predict the results.

Annie seems well suited for use in advanced theory classes where it isn't very practical to construct several antennas and test them all in a very short period of time. In fact, a wise program coordinator for your club would do well to find someone who has Annie to demonstrate it one night. It's guaranteed to hold everyone's attention.

You can superimpose several patterns on the same grid for comparison purposes. The resolution of the polar graph is quite good. Though the curves become a bit jagged at times, the results utilize the high-resolution capabilities of both the Apple and Commodore computers.

One of the few drawbacks to Annie is the lack of printing routines to accommodate various printers. Like many programs for the amateur community, this one is written by a fellow amateur, Jim Rautio AJ3K. Jim wrote the print routine for his FX-80 printer, which means it doesn't work with the Commodore printers. All is not lost since the results of Annie can be saved to tape or disk and recalled at a later time. The stored plot can be recalled later on and printed using whatever graphics/hard-copy program you may have. The routine itself should not be difficult, and Jim is actively soliciting feedback from his users for various printer configurations. By the time you read this, additional information may be available.

Annie is 100 percent machine code. The computations are complex, but they breeze along at the maximum speed allowed by the 6502 processor. It's quite impressive to watch the plot appear before your eyes as Annie calculates the pattern.

Although my tower made it up before the bad weather, my 40-meter dipole is barely 15 feet off the ground. Annie has allowed me to sit in the comfort of the office all winter long with warm feet and take a look at several possible configurations for my dipole. Now that the weather is warm, I can configure my antenna without wasting time on some of the arrangements I had originally considered.

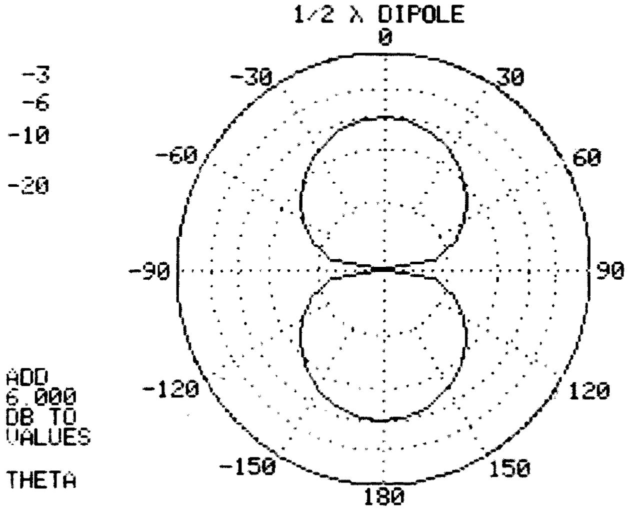


Fig. 1.

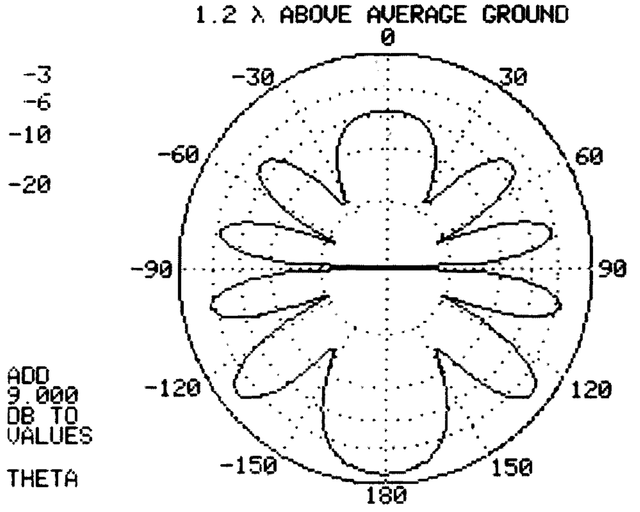


Fig. 2.

Annie is a well-thought-out and -implemented program deserving the highest marks. If you live and breathe antenna theory, it is a must. If you are like me and like to have someone/something else do the hard work for you, Annie is a welcome addition. Apple disk versions for the II or IIe are $49.95. The Commodore-64 version is available on disk or tape for $39.95.

Ordering by mail doesn't always result in the best experience. Mail-Order Annie, though, is as beautiful as they come. I wonder if when Harry Chapin sang, "All My Life's a Circle," he could have been referring to polar plots?

For more information, contact *Sonnet Software, 4397 Luna Course, Liverpool NY 13088*.

Jim Grubbs K9EI
Springfield IL

WHAT DO *YOU* THINK?

Have you recently purchased a new product that has been reviewed in *73*? If you have, write and tell us what *you* think about it. *73* will publish your comments so you can share them with other hams, as part of our continuing effort to bring you the best in new product information and reviews. Send your thoughts to Review Editor, *73 Magazine*, Peterborough NH 03458.

HAM HELP

I would appreciate a manual or schematic for the Hallicrafters SX-28 and SX-110 receivers and the Galaxy III transceiver.

Bill Richmond WD4CPQ
521 Rawlings St.
Louisville KY 40217

I need a schematic, parts list, and owner's manual for a model 70 Utility Tester, which was manufactured by Superior Instruments Co. I will be happy to pay for all copying.

Jess Jessen
Box 80
Tyler MN 56178

Needed: NAVSHIPS 0967-173-7010 Vol. 1, and 93788 Vol. 2.

Charles T. Huth WB8NLM
130 Hunter St.
Tiffin OH 44883

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

ARRL VHF QSO PARTY
Starts: 1800 UTC September 14
Ends: 0300 UTC September 15

Sponsored by the ARRL, the objective of this contest is to work as many amateur stations in as many different 2 × 1 grid squares as possible using authorized amateur frequencies above 50 MHz. Operating categories include: single operator multi- or single band and multi-operator. Single-band entries on 50, 144, 220, 432, and 1296-and-up categories will be recognized both in *QST* score listings and in awards offered. Contacts may be made on any and all bands without jeopardizing single-band-entry status. Such additional contacts are encouraged and should be reported. Multi-operator stations must locate all equipment (including antennas) within a circle whose diameter does not exceed 300 meters.

Retransmitting either or both stations or use of repeater frequencies is not permitted. Also, use of the national simplex frequency, 146.52, or immediately adjacent guard frequencies is prohibited. Only recognized simplex frequencies may be used, such as 144.90 to 145.10, 146.49, 0.55 and 0.58, and 147.42, 0.45, 0.48, 0.51, 0.54, and 0.57 MHz on the 2-meter band. Local-option simplex channels and frequencies adjacent to the above that do not violate the intent of the above or the spirit and intent of the band plans as recommended in the *ARRL Repeater Directory* may be used for contest purposes.

Stations may be worked only once per band for credit, regardless of mode. Crossband QSOs do not count. Partial QSOs do not count; both calls, the full exchange, and acknowledgment must be sent and received.

Fixed, portable, or mobile operation under one call from one 2 × 1 grid square only is permitted. A transmitter used to contact one or more stations may not be used subsequently under any other call during the contest period (with the exception of family stations where more than one call is assigned to one location by FCC/DOC); one operator may not give out contest QSOs using more than one callsign from any one location.

Only one signal per band at any given time is permitted, regardless of mode. While no minimum distance is specified for contacts, equipment should be capable of real communications (i.e., able to communicate over at least 1 km).

Multi-operator stations may not include QSOs with their own operators except on frequencies higher than 2.3 GHz. Even then, a complete, different station must exist for each QSO made under these conditions. Above 300 GHz, contacts are permitted for contest credit only between licensed amateurs of Technician class or higher using coherent radiation on transmission (e.g., laser) and employing at least one stage of electronic detection on receive.

A station located precisely on a dividing line between grid squares must select only one as the location for exchange purposes. A different grid-square multiplier cannot be given out without moving the complete station (including antennas) at least 100 meters.

EXCHANGE:

Grid-square locator (see January, 1983, *QST*, page 49). Exchange of signal reports is optional.

SCORING:

Count one point for each complete 50- or 144-MHz QSO, two points for each 220- or 432-MHz QSO, three points for each 1296-MHz QSO, and four points for each 2.3-GHz or higher QSO. The multiplier is the total number of different grid squares worked per band. Each 2 × 1 grid square counts as one multiplier on each band it is worked. Multiply total QSO points from all bands operated by the total number of multipliers for final score.

AWARDS:

Awards will be issued to the top single-operator score in each ARRL section, as well as top single operator on each band in each ARRL section where significant effort or competition is evidenced. Multi-operator awards will be issued for the top score in each ARRL section where significant effort or competition is evidenced. However, multi-operator entries are not eligible for single-band awards.

ENTRIES:

Entries must be postmarked no later than 30 days after the end of the contest and should be addressed to ARRL headquarters.

QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73* 80 Pine Street, Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

WASHINGTON STATE QSO PARTY
0100 UTC September 14
to 0700 UTC September 14
1300 UTC September 14
to 0700 UTC September 15
1300 UTC September 15
to 0100 UTC September 16

The twentieth annual contest sponsored by the Boeing Employees' Amateur Radio Society (BEARS) is divided into three operating periods, as shown. All amateurs are invited to participate. All bands and modes may be used, but no CW QSOs are allowed in the phone bands. Stations may be worked once on each band and more for contact points and more than once each band/mode if they are additional multipliers.

EXCHANGE:

QSO number, RS(T), and state, province, country, or Washington county.

FREQUENCIES:

Phone—1815, 3925, 7260, 14280, 21380, 28580.

CW—1805, 3560, 7060, 14060, 21060, 28160.

Novice—3725, 7125, 21150, 28160.

SCORING:

Washington stations score 2 points for each phone contact and 3 points for each CW contact, including contacts with other Washington stations. Multiply QSO points by the total number of different states, Canadian provinces, and other foreign countries worked.

All others score 2 points for each phone contact and 3 points for each CW contact with a Washington station. Multiply QSO points by the total number of different Washington counties worked (39 maximum). There will be an extra multiplier of one for each group of 8 contacts with the same Washington county for all non-Washington stations.

AWARDS:

Certificates will be awarded to the highest-scoring station (both single and multi-operator) in each state, Canadian province, foreign country, and Washington county. Additional certificates may be issued at the discretion of the Contest Committee. Worked Five BEARS Awards also are available to anyone working 5 club members before, during, or after the QSO party (unless previously issued). All QSO party entries will be screened by the Contest Committee for possible Worked Five BEARS Awards. Worked Three BEAR Cubs Awards are also available for working 3 Novice members. All BEARS Awards other than QSO party certificates are handled by Roy Brashear W7RJW, 5711 South 129th Street, Seattle WA 98178. (See page 28 of the August, 1979, issue of *73* for more details.)

CALENDAR

Sep 14-15	ARRL VHF QSO Party
Sep 14-16	Washington QSO Party
Sep 28-29	G-QRP-Club CW Activity Weekend
Oct 5-6	ARRL QSO Party—CW
Oct 6-7	Illinois QSO Party
Oct 12-13	Rio CW DX Contest
Oct 12-13	ARRL QSO Party—Phone
Oct 19-20	ARRL Simulated Emergency Test
Oct 19-20	Jamboree On The Air
Oct 19-20	Worked All Y2 Contest
Oct 19-21	Rhode Island QSO Party
Nov 2-3	ARRL Sweepstakes—CW
Nov 16-17	ARRL Sweepstakes—Phone
Dec 7-8	ARRL 160-Meter Contest
Dec 14-15	ARRL 10-Meter Contest
Dec 26-Jan 1	QRP Winter Sports—CW

FADCA>BEACON

THE FLORIDA AMATEUR DIGITAL COMMUNICATIONS ASSOCIATION NEWSLETTER

NEWSLETTER OF THE MONTH

The Florida Amateur Digital Communications Association (FADCA) receives September's prize for its outstanding publication, the *FADCA>BEACON*. You'll not find a great deal of information about FADCA in the *BEACON*, no minutes of the last meeting, no endless pleas for club participation. In their place is a flood of material about packet radio—reviews of new equipment, modification and construction articles, tips, and techniques, all packed into a volume that becomes more a reference book than a newsletter.

Gwyn Reedy W1BEL puts it all together each month, with a small army lending assistance. The many names that appear on the masthead include Brad Voss WB8PZE, Cheryl Voss, David Hunt, Jim Homan W4DPH, Phil LaMarche W9DVM, and Pat Shaughnessy KF4EF, all of whom help Gwyn produce this exceptional journal.

To enter your club's newsletter in *73*'s Newsletter of the Month Contest, send it to *73*, 80 Pine Street, Peterborough NH 03458, Attn: Newsletter of the Month.

ENTRIES:

Logs must show dates/times in UTC, stations worked, exchanges sent and received, bands and modes used, and scores claimed. Include a dupe sheet for entries with more than 200 QSOs. Each entry must include a signed statement that the decision of the Contest Committee will be accepted as final. No logs can be returned. Results of the QSO party will be mailed to all entrants and an SASE is *not* required. Log sheets and summary sheets must be postmarked no later than October 17th and sent to: Boeing Employees' Amateur Radio Society, c/o Willis D. Propst K7RS, 18415 38th Avenue South, Seattle WA 98188.

G-QRP-CLUB CW ACTIVITY WEEKEND
Starts 0900 UTC September 28
Ends 2300 UTC September 29

All radio amateurs interested in QRP are invited to take part in the club's Activity Weekend. No special exchange information was mentioned in the information provided by the club. The operating scheduled for this last weekend is as follows:

0900-1100 = 14060, 21060, 28060
1100-1300 = 3560, 7030
1300-1400 = 10106
1400-1700 = 14060, 21060, 28060
1700-1900 = 3560, 7030
1900-2100 = 14060
2100-2300 = 3560, 7030

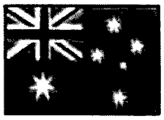
Reports on the Activity Weekend are welcomed by Christopher J. Page G4BUE, Alamosa, The Paddocks, Upper Beeding, Steyning, West Sussex, BN4 3JW England.

Full details on membership of G-QRP-Club are available from the membership secretary, Fred Garratt G4HOM, 47 Tilshead Close, Druids Heath, Birmingham, B14 5LT England.

73 INTERNATIONAL

Each month, 73 brings you ham-radio news from around the world. In this collection of reports from our foreign correspondents, we present the latest news in DX, contests, and events, as well as keep you abreast of the technical achievements of hams in other countries.

If you would like to contribute to your country's column, write to your country's correspondent or to 73 Magazine, Pine Street, Peterborough NH 03458, USA, Attn: Perry Donham KW1O.



AUSTRALIA

Kirsti Jenkins-Smith VK9NL
PO Box 90
Norfolk Island
Australia, 2899

NORFOLK ISLAND

For the DX listener to pick up Radio VL2NI, conditions have to be exceptionally freaky. Norfolk Island's noncommercial and only broadcasting station transmits daily from 1830 UTC to 1130 UTC, running 18 Watts on 1566 kHz. It is designed to cover Norfolk Island "from coast to coast," all 15 square miles of it.

Back in the early sixties, the daily transmission only lasted ten minutes. The Administration switchboard operator would leave the switchboard to briefly tell us about the weather and any meetings or other community functions to be held. That was it.

Gradually, the time on air increased to half an hour, fitting in a few birthday greetings and sometimes a short request session. The broadcasts were popular. Listening was a *must* for anyone living on the island. A second transmitter was situated at the airport, and the OIC (officer in charge) there would entertain on Saturdays, playing popular music interspersed with progress reports about the weekly flight from Sydney.

As time went on, more people became involved with VL2NI. Volunteers from the community at large took over the job as announcers, stretching the transmissions to last until lunchtime. Then ministers from various churches would go in one day each week and present a religious program, so the station actually remained on air until 2:00 pm local time.

An old commercial receiver was put to use to pick up Radio Australia's shortwave program, which then could be relayed over VL2NI. This enabled everyone to, for instance, listen to world news without the need for a personal shortwave receiver. BBC and ABC (Australia) kindly made available ready-made programs on tape, thereby creating a variety in the daily broadcasts.

In later years, VL2NI became updated with modern equipment, operating FM and AM simultaneously.

A host of announcers ensures that the station is on air all day until 11:00 pm local time. VL2NI is a "one-man show." The announcer has to do it all him/herself—arrange the records or tapes to be played, read the news, answer the phone, pick up Radio Australia, and so on. None of the announcers is trained, but they seem to manage okay.

"Doing the broadcast" is only a sideline for them all. They have other work where they earn their real living, so each does only a few hours a week. We know this, so if a particular record comes to an end, followed by silence, we don't panic and kick our sets to make them work. We know the next announcer has been delayed but will be along shortly. We also understand when a record gets stuck on a chip for a while that the announcer has had to duck out somewhere, but will be back....

The staff is enthusiastic and willing. When funds are low and the budget is strained, they have on occasion banded together and arranged fundraising cabaret nights. We then have the pleasure of seeing our announcers live on stage, doing their own thing. Always a popular evening with the public.

Once a month, the island's population sits glued to their sets listening to the Legislative Assembly meeting which is broadcast live direct from the Assembly chambers. Needless to say, many people on the island become personally interested in the doings of our politicians. The evening following the meeting is thus set aside for a rebroadcast for those who missed the original and for those who want to check up to see if they heard right the first time.

Basically, the daily broadcasts are what they have always been. "News" consists of weather forecasts and notices of meetings, the ETA of ships and airplanes, with special early-morning broadcasts to inform lighterage workers when the ship is due to start unloading. Then there are birthday greetings and requests. The birthday request session is very popular, especially among the island's young. They are not influenced by what the media dictate people to like. Here "The Teddybears' Picnic" rates head and shoulders above any pop tune. Outsiders have even been known to wonder if it is our National Anthem.

The imported programs help in keeping the station going on an all-day basis, and when the opportunity is there, the staff will broadcast direct from various sports activities and other community functions.

A resident technician keeps an eye on the equipment, again as a sideline—he, too, earns his living elsewhere.

All in all, VL2NI is a true community radio station. By community effort it has become an important medium for binding the community together. We know who has a birthday, who has had a baby, who has passed on, what meetings are to be held, what the weather will be like, when a ship is due, when the plane is arriving, and when it is "departing back"—in the unique terminology used by VL2NI. We know what our politicians are up to and, reading between the lines as it were, we can make a guess at other things.

Many years ago reports from Europe indicated that VL2NI had been heard there. So you never know your luck. It would be interesting to know if anyone in recent times has happened to hear the station on air.

CYPRUS

Aris Kaponides 5B4JE
PO Box 1723
Limassol, Cyprus

During last March, the Cyprus Amateur Radio Society had its annual general meeting. At this meeting a new Council was elected as follows—Totos Theodossiou 5B4AP, president, Aris Kaponides 5B4JE, secretary, Pantelis Lytrides 5B4CF, treasurer, and four council members, Chris Demetriou 5B4EI, Thanos Apostolides 5B4CR, Sotos Miltiadou 5B4JX, and Sotos Metaxas 5B4LB.

Larry Day 5B4LD has undertaken the task of writing up the history of amateur radio in Cyprus. We wish him luck in his research and we are sure his work will be of interest not only in Cyprus but also abroad. We hope by the end of the year to give the readers of *73* a short summary in this column.

Andreas Mavrides 5B4LP, the well known DXer, was granted a special license to experiment with a crossband system using 2m (repeaters or simplex) and 10m. We are sure that many amateurs in Cyprus will benefit from it.

Again this summer, Cyprus repeaters R4 and/or R5 are linked with SV9 and SV5 via R3 in Heraklion, Crete, or simplex connections from SV to R4 and R5 in Cyprus. The system this year is slightly different. 5R4JX, instead of using the VOX system which he constructed last year, now has constructed an rf-activated switch with a short bleep at the end of an "over," which seems to operate better than the VOX used last summer for this link. Cypriot amateurs have made many friends in SV9 and SV5 using 2m in this way. This year also, besides the usual 4X and OD5 stations on our repeaters and also on simplex, we have met often on 2m friends from SU-land, such as Ezzat SU1ER, Maggi SU1MR, Bassiouni SU1BA, and Hosni SU1HK.

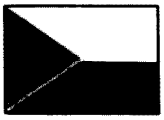
To celebrate the 25th anniversary of the Cyprus Republic, CARS has asked the licensing authority to give permission for all 5B4 stations to use the special prefix 5B25 followed by the regular suffix of each station. The period for its use is from August 16, 1985, until December 31, 1985. We are certain that the CARS application will have a positive response. It is worth mentioning that this will be the second special prefix ever used in Cyprus, the first one being 5B0, which was given for World Communication Year, 1983.

Lots of radio amateurs from Europe are visiting Cyprus as tourists, and they want a temporary license. For visitors coming from EEC countries, the USA, and Commonwealth countries, all they have to do is to apply by letter to: Telecommunications Officer, Ministry of Communications and Works, Nicosia, Cyprus. In their letter they must enclose a photocopy of their license and their address of residence in Cyprus—hotel, etc. They must also send to CARS a photocopy of their license and the letter to the Ministry. This temporary license is free of charge and sometimes can be issued over the counter in Nicosia. So if somebody visits Cyprus, a call on R5 or R2 will raise up some 5B4 amateurs.

ZC4 stations from the British bases seem to be in great demand nowadays, so I will give some tips on where and when to find some of them. First, on the W7PHO net on 14.227 MHz, usually at 2100 UTC, ZC4AB and ZC4MR have a regular appearance. On this net, I spend some time myself, and it seems that 5B4 is still DX on 20m. HI!!

On 15m, sometimes on Saturday afternoons around 1300 UTC on 21.270 MHz, you might find ZC4AM/P operating from the salt lake of Akrotiri, which is within the sovereign base area of Akrotiri.

Other active ZC4s are ZC4CZ and ZC4WW, and maybe also another couple or so from the Dhekelia base which cannot be heard from my QTH due to the skip distance.



CZECHOSLOVAKIA

Rudolf Keraba (OK3KFO ARC)
Komenskeho 1477/8
955 01 Topolcany
Czechoslovakia

QRP IN CZECHOSLOVAKIA

During the last three years, the following stations were occupied with operating QRP: OK1AIJ, OK1AMM, OK1DMP, OK1DOC, OK1DWG, OK1DZD, OK1FAO, OK1AR, OK1MBK, OK1MNV, OK2BEI OK2BMA, OK2BTT, OK2PAW, OK2SBJ, OK3YAC, OL1BBR, and ex-OL5AYF.

Among the most active hams is Pavel OK2BMA who has been operating QRP since 1979. He has made about 3,000 contacts altogether, with 100 DXCC countries on all shortwave bands. He uses his own homemade equipment. Jindra OK1AMM has also fulfilled the conditions for DXCC when operating QRP. Zdenek OK1DZD has been working on 3.5 and 14 MHz with a maximum output of 1 Watt. For the fulfillment of DXCC he lacks 25 countries. He has also been using homemade transceivers.

Another active operator is Karel OK1AIJ, who has been operating QRP since 1972, mainly on 3.5 MHz. He has made 5,000 contacts with various equipment with inputs of 1 to 10 Watts, and his contacts have been with more than 50 DXCC countries. In the 80m band, operating QRP, were the following stations: OK1FAO, OK1VLP, and OK1MNV. OK3YAO, operating QRP, has made 1,000 contacts in the 1.8–3.5-MHz band.

Among the telegraph fans in the contest on shortwave is Milan OK2PAW. Owing to his perfect operation, he has achieved remarkable results. He has been working on all shortwave bands using his own homemade equipment. In 1982, during a period of some months, OK2BEI made contacts with 50 DXCC countries and also a large number of DX contacts by using his 1-Watt transmitter. He was using the ground-plane antenna for the 14-, 21-, and 28-MHz bands. Milan OK1DMP has been working in the 14-MHz band with his 2-Watt transceiver and has devoted his time mainly to QRP contesting. He has been using the G5RV antenna and a dipole.

OL1BBR and OL5AYF devote their time to QRP in the 1.8-MHz band with 2- and 3-Watt inputs. They were working also with more distant stations. QRP activity is very high, mainly in the 1.6-MHz band, owing to the fact that in Czechoslovakia a very sensitive and perfect CW transceiver, the "M-160," began to be produced. The transceiver output is one Watt. Many stations have succeeded in making DX contacts.

The last weekend in February, 1985, was the CQ WW 160-meter SSB contest. Three members of the OK3KFO radio club, (Ivan OK3CUM, Milos OK3CZM, and Rudy OK3CMZ—the correspondent for *73*) have probably made the greatest number of

contacts in the 1.6-MHz band, operating SSB. In the contest, they were working with transceiver UW3DI (their own OK3CZM product) and a vertical antenna 28 meters high, with a total length of the radial system 2,000 meters. They made 1,200 contacts, 1,000 of which were with the USSR. (1.8 MHz is in a local band in the USSR, where there are a great many radio amateurs with various prefixes.) Under very bad conditions they succeeded in making contact with such stations as 9Y4VU, J87UEE, YV2IF, KV4FZ, UH8, UI8, UJ8, UM8, and six stations from USA.

In Czechoslovakia, the most successful hams for 1984 were recognized on December 5, 1984. The winners of the work on shortwave were the members of the OK1KRG radio club; on UHF, it was the OK1KIR radio club. Both clubs are in Prague, the capital of Czechoslovakia.

Recently, in Czechoslovakia, great attention was given to the location of the first contacts in the 160-meter band. For example, the first contact Czechoslovakia-England on 160 meters was made by OK1AA on May 5, 1946. In the morning he made contacts with G2KO and on the same day with stations GM5UT, G3SU, G6KP, G5RP, and GM3AL.

In the last few days I received the evaluation of the state contest held on the occasion of the 40th anniversary of the Slovak National Uprising—the contest was in the 1.8- and 3.5-MHz bands, operating CW/SSB. The winner in the category of individuals was Eduard Melcer OK3EY, and in the radio club contest, OK3KFO. Both are situated in the district of Topolcany in Slovakia.

ITEMS

During the improved tropospheric conditions of propagation in October, 1984, there were many contacts made between OK and G in the 145-MHz band, but only G4LAW was successful in making contact from an automobile with OK1KHI/P with a transmitter of 10 Watts and a quarter-wave antenna.

* * *

The satellites RS: At the beginning of 1985, the satellites RS5, RS7, and RS8 were working safely. RS7 was switched on only when operating "robot." RS5 was used occasionally for "codestore," and its robot was switched on. This robot has been out of order for a long period, but its transponder can be used as a one-channel converter. On January 13, Ondrej OK3AU upvalued the telemetry of RS5, RS7, and RS8 and confirmed that the state of the satellites is constantly good.

The output of RS8 in comparison with RS5 is a little lower, and the lesser sensitivity of the receiver is also visible; that, on the other hand, leads to a longer durability of the accumulator (battery). A visible decrease of the source voltage, mainly during the overloading of the converter, is seen on RS5.

* * *

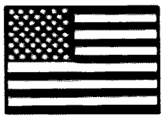
Every year, November 1 until November 15, a state contest of Czechoslovak hams in making contacts with Soviet stations (just like the contest on behalf of the Czechoslovak-Soviet friendship) is held. In the contest of individuals, OK1DNH had 1,118 points, OK1HCH had 813 points, and OK2JS had 811 points. In the contest of collective staitons, OK2RAB had 4,301 points, OK3KII had 1,145 points, and OK1KWE had 1,084 points.

* * *

RTTY: The radio club station, OK3KJF, in Bratislava, announced its 80th confirmed country, according to the list of DXCC, by operating RTTY with BY1PK, the radio club in Peking.

OK2SPS and OK2BJT, in Brno, have been producing a microcomputer system, mainly for RTTY and AMTOR, and eventually also for operating packet. As a directing microprocessor, the Z-80 has been chosen. They would like to make the acquaintance of other persons interested in this work.

In the Czechoslovak magazine, *Sdelovaci Tachnika*, there has been published an article about the use of a teleprinter as a printing machine for the ZX-81. OK1JT immediately made the necessary device and adjusted it for attachment to the transceiver and has also tested the device in operation. For the time being, a common machine has been used for reception, but during the recording of the received text, the answer is being prepared on the screen by means of the ZX-81. The answer is being broadcast automatically at one command.



GUAM

Edward L. Campbell KB6DAW/KH2
300A Rendova
APO SF 96334

HAFA ADAI FROM GUAM

I was reading the April issue and realized I had not seen anything on Guam in quite a while. I thought I would send a line or two to let the readers know that Guam is *active!*

The Mariannas Amateur Radio Club (MARC) is an active club. The club supports the island with communications for its island-wide activities. And MARC has just elected its new officers: president: John Conners KG6JIC, vice-president: David Chartier W1YRM, secretary: Edward L. Campbell KB6DAW, treasurer: Steve Shemenski KA8GVS. And our not elected but not forgotten island bureau manager is Joe Frekot AH2G.

Here are some of our more active hams. On SSB: WH2ACV, KG6RN, KG6JJH, AH2AN, KS8C, and myself; on CW: KØAX, KSØC, and AH2G; on OSCAR: W1YRM and KG8DX.

So there are many ways to contact the island. Also active was KD7P, who has left the island to return to the States. You might remember him on the Midway (KH4) DXpedition. And we all thank him for that.

In my first letter, I thought I would fill everyone in on things that I am hearing here in the Pacific. In the last couple of weeks, the States are being heard starting about 0300 UTC, with Central and South America to follow. At 0830 UTC, the HIDXA net starts with P29JS as net control. (He is also the president of the club.) There have been as many as 40 DX check-ins from around the world. Some of the check-ins are: BY5RA, VK9NL, VK0JC, KC6HA, TR8JLD, 9V1TL, A35SA, 5W1AU, and J37AH.

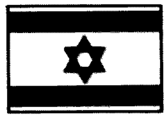
At about 0930 UTC, Europe starts to run on 15 meters. Then about 1100 UTC, Africa starts. I have a sked with my manager, ZS2DK, at 1130 UTC on 21.250 every Sunday. Then about 1330 UTC, the States start again. Most of the stations I hear are pointed to Europe, not knowing that the Pacific is running. I had a nice QSO with KV4AD and W2EMN/C6A at about 1230 UTC on 20 meters. Plus I try to catch the PHO net starting at about 1900 UTC on the weekends. Also on 14.215, the Pacific DX net starts with KB7OC and the group.

In the two years that I have been a ham, I have worked 205 countries and all 50 states. I have 136 countries confirmed. Being in the middle of the Pacific has its advantages.

Anyone who comes to Guam can find a lot of fun with ham radio. DX is usually open to some part of the globe. We do have two repeaters here on the island. They are on .64/.94 and .28/.88. So please bring your HT along if you come. Our club meets on the first Tuesday of each month, and all visitors are invited to come by. H44IA was our last visitor.

I hope to continue to bring you news from the Pacific and the island of Guam. If you hear any of us, please give us a call. We are always happy to rag-chew.

So 73 from Guam, "Where America's day begins."



ISRAEL

Ron Gang 4Z4MK
Kibbutz Urim
Negev Mobile Post Office 85530
Israel

Since our last column, there is quite a bit of news to catch up on.

REGULATIONS UPDATED AND LIBERALIZED

Beginning the first of May, a new table of frequency allocations and power outputs went into effect which has now brought the privileges of Israeli amateurs in line with those of hams from the most advanced countries.

The big item was the allowing of 1500 Watts output on all HF bands (excluding 10, 24, and 18 MHz where maximum output is 1 kW) for amateurs holding the Grade A license. Grade B licensees are now allowed 150 Watts out, and Novices 15 Watta out, gaining exemption from the need to be crystal-controlled and gaining the choice 7-7.05 section of the 40-meter band instead of the 20-kHz section held higher up in the band where they had to try to compete with horrendously powerful broadcasting stations. They retain their 21.1 to 21.15 segment of the 15-meter band and will now be able to purchase commercially-made QRP transceivers.

Thus, along with the United States and Britain, our power is defined by being the peak envelope power output instead of input power dc of the carrier as was the case in the past.

The other big expansion is in the realm of the UHF and SHF spectrum. In the past, only six bands were defined above 70 centimeters, but now there are ten: 1.2, 2.3, 3.4, 5.6, 10, 24, 47, 75-81, 142-149, and 241-250 GHz. As with 160 meters and the WARC bands, Grade A amateurs enjoy full frequency privileges, whereas Grade B licensees have narrower bandwidth in order to provide an incentive to upgrade.

Now, in the VHF and UHF spectrum, the Ministry of Communications had been cutting power outputs for all services in order to clean up the rf-saturated environments of the cities, where problems of intermod have all but become a way of life. Thus, on the 144- and 430-MHz bands, peak FM power output is now 250 Watts for Grade A and 100 for Grade B, but after considerable haggling, the Ministry made an exception for SSB and CW, so that the hardy band of EME and DX experimenters can use 1000 and 150 Watts output for Grades A and B, respectively.

Another point of interest is the deletion of the CW subbands, so that where the individual amateur uses what mode is left to his discretion and IARU recommendations. The one "loss," as it were, is making the 10-MHz allocation fit the IARU region one band plan—SSB will no longer be allowed here except under emergency conditions to protect human life or property.

The foregoing is, of course, a condensation of the main points of a Ministry of Communications circular. It must be stressed that these new regulations did not come on their own accord, all by themselves. Rather, they are the result of a small dedicated group of amateurs in the Israel Amateur Radio Club who labored intensely to submit a list of proposals to the Ministry and persistently bargained with government officials, at all times keeping an atmosphere of a cordial and businesslike relationship.

All the radio amateurs of all license classes in Israel gained greatly from the new regulations, and no longer can any amateur find a valid reason for not supporting his national organization. IARC dues for a year represent less than one percent of what I believe the average amateur has invested in his station, and thus it is an excellent low-cost insurance to protect this investment.

THE DEAD SEA EXPEDITION

In the April issue of *73*, I announced this expedition to the lowest spot on the face of the earth; it took place from the sixth through the thirteenth of that month. At the camp of 4X5DS (Dead Sea), a number of tents were set up. One housed a station driving a triband beam, and another was equipped to load a longwire for 160, 80, and 40 meters. Operators were 4X4AT, 4X6DW, 4X6LQ, 4X6KT, 4X6OM, 4X6FR, 4X6LD, 4X4MU, 4X6LB, 4Z4OL, 4Z4UK, 4Z4VH, 4X6KF, 4X8KJ, and DL9BBS, keeping the two stations going on CW, SSB, and RTTY.

Somewhat over 3300 contacts were made during the week, all continents, and some pretty rare places were contacted. Unfortunately, due to the poor conditions and difficult location (being located half a mile east of a 1000-foot-high cliff), few contacts were made with the United States.

4X4FU, manager of the Israeli QSL bureau, has reported that he has already processed *all* the outgoing cards for the expedition, the participants of the expedition having decided *not* to wait for incoming cards first to arrive and then answer them. The organization of the operation was mainly by Ahron 4X4AT and the Bat-Yam-Holon club, and all expenses were paid by those participating. Ahron asked me to stress that at no time were funds solicited from outside sources, and that QSLs were sent at the club's own initiative. In this way, he wanted to make this expedition an example of how he feels that all amateur projects of this sort should be carried out.

4X85WSE

Only two weeks after the Dead Sea operation ended, many of the amateurs responsible for the above set up a station at the week-long World Stamp Exhibition that took place at the Tel Aviv Fair Grounds, showing the visiting public *another* way of collecting countries. One of the highlights was the visit of the President of Israel, His Excellency Mr. Haim Herzog, to the pavilion and his receiving an explanation of how amateur radio fosters international goodwill.

NEW AMATEURS

In April, the Spring amateur-radio examinations were held by the Ministry of Communications. Although unfortunately many examinees came inadequately prepared, many did pass, and as a result we now have 29 new licensed amateurs in the country. In terms of callsigns being is-

sued, we are now almost at the end of the 4X6s (two-letter suffixes, with Novices having an N inserted after the 6). The 4X6 prefix, of course, came after the 4X4s and 4Z4s were completed in 1965 and 1979, respectively. At this rate, it looks like our growth rate is continually increasing, and let's hope that we do not hit a slump.

THE IARC ANNUAL ASSEMBLY

On the thirtieth of May, the Israel Amateur Radio Club held its annual membership assembly at the Bar Ilan University just outside of Tel Aviv. A few hundred members were present for the giving out of awards, an open forum to air viewpoints and propose resolutions, and the election of a new board of directors for the coming year.

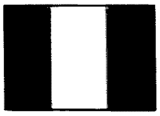
This year's assembly was noticeably quite low-key, with virtually no controversial issues raised and a clean bill of health given by the watchdog committee that was elected in order to report any deviations by the executive from our club's constitution.

Amongst the many awards given out, Yair 4X4GI was proclaimed Amateur of the Year, and the huge ovation given demonstrated the membership's overwhelming agreement. Since November, Yair has been voluntarily giving biweekly lectures to the amateur public on the subject of satellite communications under the auspices of AMSAT Israel. In addition to the many articles he has published on the subject, these lectures have broadened the knowledge of all attending, making the consciousness of this space-age mode of communications widespread amongst Israeli radio amateurs.

Elections were held, and the new executive is composed of 4X4s AT, GE, GT, GP, KM, MP, SH, and 4X6s LD, MP, KJ, and OM. In their first meeting they will divide the responsibilities amongst themselves. The membership committee consists of 4X4FR, 4X6s AS and KF, and on the new watchdog committee sit 4X4BR, 4Z4LY, and 4X4-487 (SWL). We all wish them success plus massive cooperation from the rank and file membership, without which their mission will be most difficult, if not impossible.

4X6MF

It is with great regret that we announce the passing of Dr. Steve Friedland 4X6MF (WA6DBP). Steve was responsible both for the setting up of the 4X6TU beacon on the 14.100-MHz international beacon net and the Israeli chapter of AMSAT. Working both abroad and at the Tel Aviv University, Dr. Friedland made many important contributions to the field of science. He will be sadly missed.



ITALY

Mario Ambrosi I2MQP
Via Stradella, 13
20129 Milano
Italy

The contest season is over, and even if the propagation has not been too good, it has given some good results on all bands and in particular on 40 and 80 meters. You can see in the photos two of the Italian top contesters, I3MAU and I2VRN.

Renzo I3MAU is always active in the most important events of the year; you can find him regularly in world top scores on a multi-single or multi-multi team. His antennas are always impressive—a two-element loop on 160 and 80 meters, a 4-element quad on 40, and 6-element monobander quads on 10, 15, and 20.

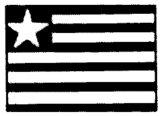
Renzo has found some problems in supplying power enough when all six stations are running. He has moved out of town to find space enough for his towers, and the power line is not enough for him. So he had to put some generators outdoors to give power to two of the stations. In the photo you see only his standard station, but when all his friends join him, the amount of gear is as impressive as his antenna farm.

Roberto I2VRN works mainly on 40 meters. At the present he is using a 4-element wide-spaced monobander that gives a lot of satisfaction. In a couple of months, a new monster should be on the air, a 6-element wide-spaced quagi on a boom 100 feet long. All elements are already prepared and the boom is being tested before it is mounted. The boom weight will be 500 pounds and the whole will weigh approximately 1000 pounds. Roberto and his friends had to study a particular kind of tower and a very sophisticated rotating system that includes a transmission with oil under the pressure of 10 atmospheres. (Sorry, but I do not know how to convert it into pounds-per-inch: It's too complicated.)

During the weekend of May 18 and 19, the first international Italian contest was on the air. The participation of stations out of Italy was a real surprise. The 20-meter band was crowded with stations coming from all over the world. We all had the opportunity to work a lot of USA stations as well as a lot of USSR, European, and Japanese hams. If you had any contact with I stations, please send your log. You will receive a participation certificate, and the first three US stations will also get a medal.

This contest also gave the opportunity to work IY1 and IY4 prefixes—the first one being the QTH from where Marconi did his work, while the second was his home QTH. Remember that all contacts you had with Italian stations during the contest are accepted for the Worked All Italian Provinces Award, without the need for you to receive the corresponding QSL card.

And still talking about awards, I1BSN has just received his last card for the 5BWAZ, worked all zones! Franco, an electronic engineer, made a lot of effort to get it and is now starting to concentrate on the 5BWAS; if you hear him, please help him!



LIBERIA

Brother Donard Steffes, C.S.C.
EL2AL/WB8HFY
Brothers of the Holy Cross
St. Patrick High School
PO Box 1005
Monrovia
Republic of Liberia

The Liberia Radio Amateur Association has done a public service—believe it or not!

We have proclaimed ourselves to be a public-service organization, and in all honesty we have been looking for something to do. It seems that the most we have been able to come up with is a weekly weather report up and down the limits of Liberia. This has been fun. We know the temperature and rainfall in all parts, and if there is a storm with lightning or a torrent of rain, we know all about it. We have records and averages from year to year. But—is this public service? Everybody knows that there is a rainy season and a dry season. When you report that it rained 227 inches in a given year, people may react, "Oh, that much?" but then they will say, "Well, I guess so."

In the history of amateur radio in Liberia, things have been done which were really great and which stand as a credit to the amateurs of Liberia and to the amateurs of the world. The story of the Lassa fever epidemic is a prime example. In recent years, however, our record is not so good, and in the case of the Mono River disaster, the amateurs were not there.

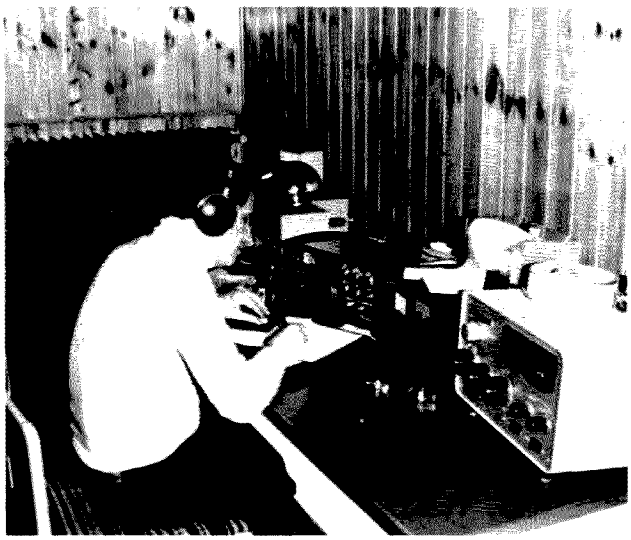
Then on Saturday, March 16, 1985, at seven hundred UTC, it happened. The amateurs received an official request to supply communication at the first annual Omega Run, which was sponsored by the American Women in Liberia. We went out with our HTs and demonstrated real amateur efficiency. We set up a base station (net control), then we deployed HT operators at strategic positions around the race course. Yours truly manned the half-way point (which was also a first-aid station) and had drinking water for those who felt the need for it. We had an operator at the hospital in town and had an ambulance on standby at the site of the race.

The Omega Tower is the highest man-made structure in Liberia (1100 ft.). It holds up one end of a dipole antenna which forms part of a worldwide navigation system. The antenna tower is supported by guy cables anchored along the circumference of a circle of 5 kilometers. The service road forming this circle served as the race course.

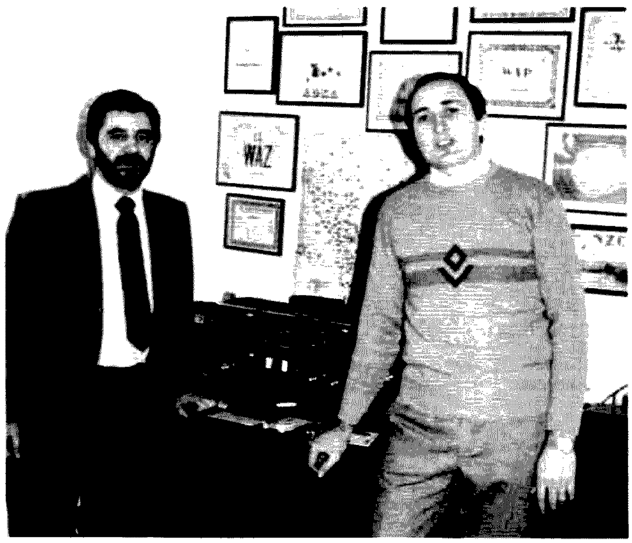
The American Women of Liberia are a very active group; they gather funds to be used for scholarships. They are interested especially in helping deserving students on the high-school level. Their work is effective and appreciated in Liberia.

The races were in no way designed for trained athletes. Participants were old and young, fat and lean, and even several that were handicapped. One brave soul did the whole length on one leg and a pair of crutches.

It was the job of the amateurs to monitor the whole course and report accidents. We were instructed to watch for symptoms of heat prostration because the day was very hot and participants were not in very good physical condition. In general, we reported on the progress of the race



Italian contester Renzo I3MAU.



I2AOX and I2VRN at I2LLD's shack.

and announced the times as the runners passed various points.

Everyone had a grand time. Some of the people who participated in the race ran, some walked, some rested now and then, but everyone finished. One race was 5 kilometers and one was 10. Entry fees netted thirteen hundred dollars for the sponsors, and the runners are already training for next year.

The work of the amateurs was appreciated and we have a letter from the American Women in Liberia to prove it. Anyway, it was a kind of a first. We pulled it off in true amateur tradition, and we are looking forward to next year.

ABOVE AND BEYOND

Peter H. Putman KT2B
84 Burnham Road
Morris Plains NJ 07950

One of the questions that is most frequently asked by newcomers to the VHF/UHF spectrum pertains to feedline. I'm quite surprised to find as many hams as I do who spend several hundred dollars for a multimode transceiver for 2 meters, add on a 100-Watt amplifier, and then feed their 13-element beam with RG-8/X cable!

On the VHF/UHF bands, the transmission line can be the most critical link in the entire system. Cables that perform well on the HF bands can exhibit considerable loss at 220 and 432 MHz. And marginal types of cables at HF become virtually useless at 144 MHz. It's important to know what to use and when to use it in your VHF station—even if you're just running a small vertically-polarized beam on your rooftop to access the local repeater with your hand-held.

To begin with, rf currents travel on the skin of the conductor at these frequencies, not through it. At some point in the frequency range, it even becomes impractical to use a "solid" conductor as we know it to carry these currents, hence the use of waveguides at microwave frequencies. To further complicate matters, the dielectric used in coaxial cable (that is, the insulating material between the center conductor and shield) can also absorb a significant amount of rf energy as you go higher in frequency.

Finally, at higher power levels the cable itself may break down due to arcing over the dielectric. Many is the time I've seen conventional RG-8/U blown apart from being used with a kilowatt on two meters. The cable heats up due to absorption by the dielectric and eventually self-destructs. So what's the aspiring VHFer to do?

Not to worry! There is an excellent selection of coaxial cable on the market to fill the need of the VHF and UHF enthusiast at a reasonable price. These cables are reliable and easy to use. They use standard connectors (with the exception of hardline) and some exhibit very low loss characteristics for frequencies as high as 1296 MHz using soft-cable construction. These cables are readily available from many advertisers in *73*.

Before we delve into that, let's look at why you *can't* use certain cables if you expect to maximize your station's VHF/UHF performance. One typical popular cable is RG-58/U, also available as RG-58/AU. This small-diameter 50-Ohm cable works well as a feedline in short runs on 160, 80, and 40 meters. For many Novices and newcomers to the hobby, this might have been the first cable ever used in the station. With a rated loss of about 1.0 dB/100 feet at 7 MHz, it worked just fine.

Now our budding ham has gotten a Technician license and has put up a quick installation to access the local 2-meter repeater with a handie-talkie, using what might be an old piece of RG-58/U running about 100 feet out of the shack around the roof to a small 4-element beam. Driving this with his mighty 2 Watts, there is concern when no one comes back! A quick glance at the loss charts shows that RG-58/U exhibits 6 dB of loss at this frequency. Whoops! Our budding Technician might better call the repeater on the phone to make a solid contact, as only 500 milliwatts are being delivered to the antenna, which doesn't have all that much gain to begin with.

A conversation with one of the local experienced hams brings the suggestion that our Tech scamper on down to the nearest radio store and buy a length of RG-8/U cable instead. Okay, that's a better choice since conventional solid dielectric RG-8/U has about 2.5 dB of loss at 144 MHz and can also handle more power if needed. (This is assuming that our Tech has gotten smart and picked up a power amplifier of about 25-30 Watts!) This means that slightly more than half the power generated at the station is making it to the beam antenna.

Now, let's assume that our budding Tech has been reading the monthly amateur journals and has discovered the newer lower-loss cables such as Belden 8214, Saxton 8284, or Belden 9913. After deciding to make the necessary additional investment, he goes for the 9913 and now finds that his loss per 100 feet is only 1.5 dB! (And it ought to be for a price of 45 cents a foot, he thinks!)

This scenario could go on and on. Our budding Tech might decide to go crazy and put in 1/2" aluminum-jacketed hardline, which has just under 1 dB of loss at 144 MHz per 100 feet, or if he's got a rich uncle, shoot the works and put up 7/8" 50-Ohm hardline, which has the best loss figures—.65 dB per 100 feet at 144 MHz.

As you can see, there are many options available. The rule of thumb is to buy the best cable your budget can afford, since using a cheap cable after a $900 UHF multimode kind of negates your purchase. The most common complaints regarding the lack of performance of VHF and UHF transceivers from newcomers to these bands are usually caused by inadequate antennas and transmission lines! If you buy an IC-271H and a Henry 2002 1-kW 144-MHz amplifier, don't use conventional RG-8/U unless you want to give your neighbors a spectacular fireworks display from your rooftop!

Believe it or not, there are times when having a cable with high loss characteristics can actually be *useful* to the VHF/UHF enthusiast! For example, let's say you'd like to tune up a home-brew 100-Watt solid-state amplifier but don't have an adequate dummy load and don't wish to shock the airwaves with your signal (which might not be too clean yet!). You do have a small 25-Watt dummy load that works well, but that's it. No problem! Just find 100 feet of old RG-58/U and put connectors on both ends. Attach your 25-Watt dummy load to the far end and connect the other to your amplifier. The coax will take care of the first 6 dB (75 Watts) and your dummy load can handle the rest with ease. This technique is also useful for reducing the drive to some of the more popular high-power VHF and UHF amplifiers, such as the Henry series.

A quick glance at Table 1 will show what you can expect from the more commonly-available transmission lines used at VHF and UHF frequencies.

As you can see, selecting the right feedline for your needs can mean the difference between using your coax as a dummy load and making that contact on meteor scatter!

What you ultimately use is up to you and your station requirements. It's amazing how many folks rush in and buy equipment for the VHF/UHF bands without having some idea of what they'll use it for in the first place! A small amount of time spent before this initial purchase will help you not only to select the best equipment for your needs (we'll cover this in future columns), but also the best type of coax to use. You may be content to know that your Belden 9913 is delivering about 65 of the 100 Watts you're pumping into it to the 22-element yagi up on the tower. Or maybe you want to get every ounce of the power from your home-brew 6-meter kilowatt to the stacked 7-element beams on the roof, so you use 7/8" hardline.

The trick is to avoid putting yourself in a hole by losing all or most of your signal in the coaxial line. Note that I have referred only to coaxial transmission lines to this point; while balanced line or twinlead may have a lower loss characteristic up to about 150 MHz, it just isn't practical for 99% of all amateur installations.

One final area to be touched on is the choice of connector, and there certainly are a lot of 'em! PL-259, BNC, type N, HNC, TNC, SMA—it begins to sound like a meeting of lobbyists with all those abbreviations! In practical use, however, most amateurs are familiar with three types of connectors: the standard PL-259, or "UHF" connector (what a misnomer!), the type-N connector (long a military standard), and the BNC miniature connector.

Most hams are acquainted with the UHF connector, more appropriately called the PL-259 or 83-1S series from Amphenol and other manufacturers. Believe it or not, this is *not* a 50-Ohm connector. However, we usually don't notice the difference at lower frequencies and they are rather easy to put on and cheap. But as the frequency climbs, the impedance "bump" that this connector creates in the transmission line can then translate into wasted power—as much as 2 dB at 432 MHz, if it is an inferior grade plug (usually with a cheap dielectric!). Some attempts have been made to cure this problem by using a Teflon™ dielectric, and these types of UHF plugs work much better at 144 and 220 MHz. I've just tested one of these plugs at 1296 with a 10-Watt amplifier and found it to have about 1.5 dB of loss at this frequency, which still isn't good enough.

The best choice? Type-N connectors, also known as UG-21. These are available from many sources including Amphenol and Kings. They are not all that expensive. They are comparatively easy to assemble, are watertight, and best of all are *true* 50-Ohm connectors! Replacing the previously-mentioned UHF connector at 1296 with a type N resulted in picking up that 1.5 dB back again! Type-N and UHF connectors are available to fit a wide variety of cables, from RG-58/U up to RG-8/U foam coax. The new 9913 works well with PL-259s, but the center #9 conductor must be filed down to fit a standard type-N connector.

The third connector mentioned was the venerable BNC connector, which many of you will recognize from your 2-meter HTs. This is sort of a miniature type-N connector and also looks like 50 Ohms. It too is watertight although somewhat more tricky to make up. These connectors are excellent for low-power applications (under 200 Watts) and make good choices for interconnecting cables. I use 'em at 432 and 1296 for portable stations, with short lengths of superior-grade RG-58/U or RG-146/U Teflon cable. These lengths are usually under 10 inches. Again, BNC connectors (or UG-88-type connectors) are commonly found from most major manufacturers.

If you choose to go the hardline route, there are many specialized connectors available which we'll touch on in later columns. Until next month, see you "Above and Beyond."

Loss in dB/100 ft.

Cable Type	50 MHz	144 MHz	220 MHz	432 MHz
RG-58/U (50-Ohm)	3.5	6	7.5	N.A.
RG-59/U (75-Ohm)	2.7	4.5	5.5	8
RG-8/A (50-Ohm)	1.75	3	4.5	6
RG-8/U (50-Ohm)	1.25	2	2.5	3.5
RG-11/A (75-Ohm)	1.75	3	4.5	6
Belden 9913 (50 Ohm)*	1	1.6	2.0	2.7
RG-17, 18 (50-Ohm)	.65	1.3	1.75	2.5
1/2" 75-Ohm hardline**	.6	1.2	1.4	2.2
1/2" 50-Ohm hardline	.5	1.0	1.2	1.75
7/8" 50-Ohm hardline	.35	.65	.9	1.3

Additional Notes

* Belden type 9913 is an unusual cable in that while it is basically a soft-type RG-8/U cable, it uses an air dielectric around a low-loss #9 conductor to achieve its low loss characteristics. The advantages of such a cable are not lost on those readers with VHF/UHF arrays on crank-up towers!

** 75-Ohm hardline is surprisingly easy to obtain. Many cable-TV operators discard short runs at the end of a long spool used for wiring up a street or a block of streets. These short runs can turn out to be as long as 200 feet, and the cable can be had usually for free just by asking. Many hams sell homemade connectors for this hardline using brass pipe fittings, and they are spotted at flea markets frequently! Although the impedance is not 50 Ohms, using this cable without a matching network often results in no worse than a 1.5:1 vswr (and due to manufacturers' inconsistencies, it's often lower than that!). Tube amplifiers will tune it with ease. This cable is a good choice at 220 and 432 MHz!

Table 1.

DEALER DIRECTORY

Culver City CA

Jun's Electronics, 3919 Sepulveda Blvd., Culver City CA 90230, 390-8003. Trades 463-1886 San Diego, 827-5732 (Reno NV).

Fontana CA

Complete lines ICOM, DenTron, Ten-Tec, Mirage, Cubic, Lunar, over 4000 electronic products for hobbyist, technician, experimenter. Also CB radio, land-mobile. Fontana Electronics, 8628 Sierra Ave., Fontana CA 92335, 822-7710.

San Jose CA

Bay area's newest amateur radio store. New & used amateur radio sales & service. We feature Kenwood, ICOM, Azden, Yaesu, Ten-Tec, Santec & many more. Shaver Radio, Inc., 1775A S. Winchester Blvd., Campbell CA 95008, 370-6665.

New Castle DE

Factory Authorized Dealer! Yaesu, ICOM, Ten-Tec, KDK, Kenwood, AEA, Kantronics, Santec. Full line of accessories. No sales tax in Delaware. One mile off I-95. Delaware Amateur Supply, 71 Meadow Road, New Castle DE 19720, 328-7728.

Preston ID

Ross WB7BYZ has the largest stock of amateur gear in the Intermountain West and the best prices. Call me for all your ham needs. Ross Distributing, 78 So. State, Preston ID 83263, 852-0830.

Littleton MA

The reliable ham store serving NE. Full line of ICOM & Kenwood. Yaesu HTs, Drake, Daiwa, B&W accessories. Curtis & Trac keyers. Larsen, Hustler, Telex/Hy-Gain products. Mirage amps., Astron P.S., Alpha Delta protectors, ARRL & Kantronics instruction aids. Whistler radar detectors. Full line of coax fittings. TEL—COM Electronic Communications, 675 Great Rd. (Rt. 119), Littleton MA 01460, 486-3400/3040.

Derry NH

Serving the ham community with new and used equipment. We stock and service most major lines: AEA, Astron, Azden, B&W, Cushcraft, Hy-Gain, Hustler, ICOM, Kenwood, KLM, Larsen, Mirage, Mosley; books, rotors, cable and connectors, Business hours 9–7 Monday through Thursday, and 9–5 Friday and Saturday. Rivendell Electronics, 8 Londonderry Road, Derry NH 03038; 434-5371.

Albany, New York
UPSTATE NEW YORK

Kenwood, ICOM, Ten-Tec, Belden, Cushcraft, Larsen, Hustler, ARRL, Hy-Gain, B&W, MFJ, Mirage. New and used equipment. Serving the amateur community since 1942. Adirondack Electronics, Inc., 1991 Central Avenue, Albany NY 12205, 456-0203 (one mile west of Northway exit 2W).

DEALERS

Your company name and message can contain up to 25 words for as little as $150 yearly (prepaid), or $15 per month (prepaid quarterly). No mention of mail-order business or area code permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the December '85 issue must be in our hands by October 1st. Mail to 73 Magazine, Peterborough NH 03458. ATTN: Nancy Ciampa.

PROPAGATION

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA								15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40	40		20	15	15	15	15	
SOUTH AFRICA									15	15	15	
U. S. S. R.							20	20				
WEST COAST			80	80	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
SOUTH AFRICA										15	15	20
U. S. S. R.								20	20			

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20					15
PHILIPPINES	15						40		20			
PUERTO RICO			20	20	20	20	20	20				15
SOUTH AFRICA										15	15	
U. S. S. R.									20			
EAST COAST		80	80	40	40	40	40	20	20	20		

G = Good, F = Fair, P = Poor.

SEPTEMBER

SUN	MON	TUE	WED	THU	FRI	SAT
1 F	2 P	3 P	4 P	5 F	6 F	7 G
8 G	9 G-F	10 F	11 F-G	12 F	13 F-G	14 F
15 F-P	16 P-F	17 F	18 G	19 G	20 F	21 G-F
22 F	23 F-P	24 P	25 P-F	26 G	27 G	28 G
29 G	30 G					

Issue #301

OUR 25th ANNIVERSARY YEAR!

October 1985
$2.50 USA
$3.50 Canada

73 for Radio Amateurs

® A CWC/P Publication

International Edition

ANNIVERSARY PRIZE-WINNERS!

Is Your Name Inside?

1985 15/20m SSB World Champions

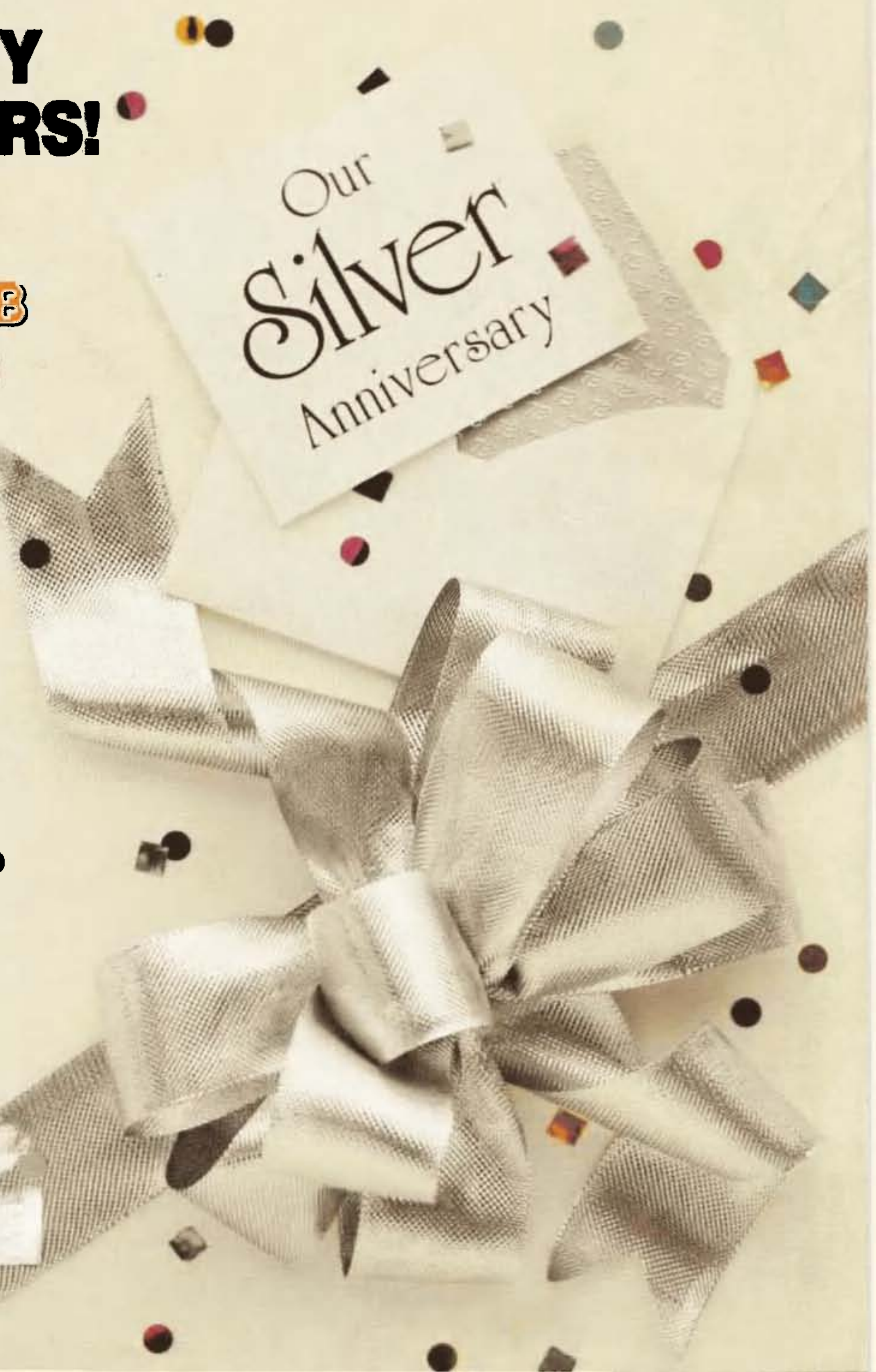
Old Tubes Never Die!

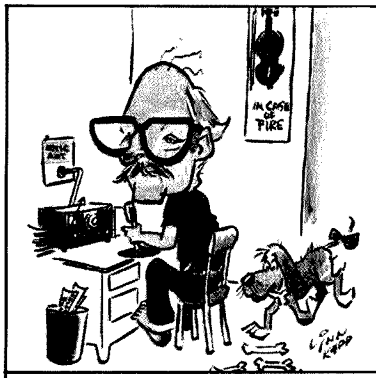
High-Flying OSS Radio

Floppy Disks: Worth The Price?

Read "What?"

Page 4





73 for Radio Amateurs®

ISSUE #301 OCTOBER 1985

On the Cover: Photography by Frank Cordelle, Bennington, New Hampshire. Design by Dianne Ritson. **Above:** Bandel "Pappy" Linn K4PP is one of our Silver Eagle winners. We asked him for a self-portrait.

4 **What?**
7 **QRX**
58 **Barter 'N' Buy**
59 **Special Events**
61 **Satellites**
64 **RTTY Loop**
64 **Be My Guest**
65 **Letters**
67 **Review**
68 **Contests**
72 **Ham Help**
76 **New Products**
78 **Above and Beyond**
80 **Fun!**
86 ***73* International**
94 **Dealer Directory**
94 **Propagation**
95 **List of Advertisers**

18 Silver Eagle Awards
. . . . Editors

22 Talk Is Cheap
Good news: Now you *can* afford a speech synthesizer! You have our word on it. WB6NQK

32 Takin' It to the Streets—Part II
Last month's discussion was only half of the story—now discover what remote control can do when the ShackMaster's power is unleashed! WA6AXX

36 Above Intercept
It is cramped and dark and freezing cold, but the Allies need information. Has Britain's secret radio fallen into enemy hands? . . . . Layton

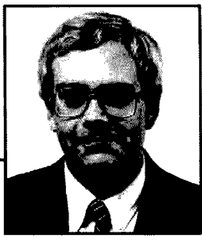
40 Build a 1296 Stripper
Join the fun on 1296 MHz with WB6IGP's stripline downconverter. WB6IGP

46 Looking East
Silver Eagle award-winner Bill Pasternak recalls his 25-year relationship with W2NSD and *73*. WA6ITF

50 Old Tubes Never Die!
Discover the romance of glowing filaments. W6HDM

56 Give Your Disks a Physical
Are you getting what you pay for? Use this simple technique to quality-inspect your valuable floppies.
. . . . Kraska

Editorial Offices: Pine Street, Peterborough NH 03458, phone: 603-924-9471. **Advertising Offices:** Elm Street, Peterborough NH 03458, phone: 603-924-7138. **Circulation Offices:** Elm Street, Peterborough NH 03458, phone: 603-924-9471. **Manuscripts:** Contributions in the form of manuscripts with drawings and/or photographs are welcome and will be considered for possible publication. We can assume no responsibility for loss or damage to any material. Please enclose a stamped, self-addressed envelope with each submission. Payment for the use of any unsolicited material will be made upon acceptance. All contributions should be directed to the *73* editorial offices. "How to Write for *73*" guidelines are available upon request. US citizens must include their social security number with submitted manuscripts. **Subscription Information:** Rates: in the United States and Possessions: One Year (12 issues) $24.97; Two Years (24 issues) $38.00; Three Years (36 issues) $53.00. Elsewhere: Canada and Mexico—$27.97/1 year only, U.S. funds. Foreign surface mail—$44.97/1 year only, U.S. funds drawn on U.S. bank. Foreign air mail—please inquire. To subscribe, renew or change an address: Write to Subscription Department, PO Box 931, Farmingdale NY 11737. Send Canadian changes of address to: 73, PO Box 1051, Fort Erie, Ontario CANADA L2A 5N8. Return postage guaranteed. For renewals and changes of address, include the address label from your most recent issue of *73*. For gift subscriptions, include your name and address as well as those of gift recipients. For questions concerning your subscription and to place subscription orders, please call us toll free at 1-800-645-9559 between 9 am and 5 pm or write to *73*, Subscription Department, PO Box 931, Farmingdale NY 11737. *73 for Radio Amateurs* (ISSN 0883-234X) is published monthly by CW Communications/Peterborough, Inc., 80 Pine Street, Peterborough NH 03458. Second class postage paid at Peterborough NH 03458 and at additional mailing offices. Canadian second class mail registration number 9566. Microfilm Edition—University Microfilm, Ann Arbor MI 48106. Postmaster: Send address changes to *73*, Subscription Services, PO Box 931, Farmingdale NY 11737. Nationally distributed by International Circulation Distributors.



WHAT? News from the Publisher

Welcome to our 25th Anniversary issue. There they are—the words very few ever get to write and print. Even though I'm a hardened veteran of almost eleven of these crazy twenty-five and know a lot about the other fourteen, I get soft when I try to describe what this issue means in itself and what it has in it as well. I don't mind saying that I've been brought to tears this year—me, a big rugged guy—when thinking about the people and efforts that have made *73* a go.

Why don't we start with some *73* stats. Only one of every 100 new magazines lasts for more than 10 years; those lasting 25 years are approximately .007 *percent* of new starts, at best. *73* has printed more than 43,510 pages so far. If one person—ONE PERSON—worked full-time for 25 years, that's 52,000 hours, minimum. We recently purchased article #11582. We have paid more than $1.62 million to our authors, columnists, artists, and photographers.

Scary. Just like trying to narrow down our Silver Eagle winners (page 18). Before you turn there, I want you to know that Wayne W2NSD wasn't even considered. (He already has one, anyway.) As I explained to Wayne in August when he was about to make applesauce (for the recipe, see "Never Say Die," October, 1979), no way. "What do you have in mind?" asked Wayne. "Not telling *you*, that is for sure." When you're the founder and heart and soul of a magazine for 25 years, you deserve the best sort of surprise. That's what Wayne will get. We will let you know what it is as soon as it's done. Think video and thank SWAT (Secret Wayne Appreciation Team).

Thank, too, our advertisers. Without their daring and dollars over the years, you never would have had the opportunity to buy what you did and do. You never would have been able to see the kinds of reviews and new product announcements (including some weird ones this month) you regularly expect. Thank, too, companies whose products are good, operations small, and dreams unlimited. Thank again the biggies such as ICOM, Kenwood, and Yaesu who strive to beat one another and in so doing engineer another miracle.

How about advertising heroes. One group is made up of purchasers of the postcards bound into the middle of this issue. We thought this would be a relatively cheap, really revolutionary way to reach buyers quickly—and to get a response.

The second bunch is really simple to name but hard to describe: advertisers who were with us in 1960 and are still with us in 1985. Barry Electronics. Fair Radio. International Crystal. Radio Amateur *Callbook*. Slep Electronics. Do me a favor, please, and get in touch with these people—if only to say thanks for supporting *73*. They have as much of a share in helping celebrate our 25th as anyone else—and probably more.

And then there's you, our reader, last in line you think. Wrong. My monthly calls to letter-writers went out this month to Ohio, Maine, Kansas (randomly selected), and to a country overseas. I hope *that* writer can get back to us at some time, by the way. When you carefully reach the right name at the right address and the amateur who's contacted *you* says, "No, wrong number!", something is wrong. As part of our 25th year, I'd like to let everyone around the world know that *73* appreciates hams who care enough about their hobby to contact us, whether they agree or disagree with what we're doing.

We had one goal when we started to put this issue together: Be truthful, the rest be damned. We ended up with more. To dedicate it to Wayne Green W2NSD. To do some special things for randomly-selected readers representing DX (1), DC (1), and the fifty states (50). Here they are:

1. Rune Eriksson SM6BNE, Sweden
2. Walter Scott W3UTJ, District of Columbia
3. Francis Dole KB4FHR, Alabama
4. Lew M. Williams, Jr., Alaska
5. W. Philip Sawyer WD4FAK, Arizona
6. Joe Karr, Arkansas
7. Jimmie Hardy, California
8. Raymond Eisner, Colorado
9. Eugene Modzelewski, Connecticut
10. Dave Stepnowski KC3AM, Delaware

Continued on page 62

73 for Radio Amateurs is a member of the CW Communications/Inc. group, the world's largest publisher of computer-related information. The group publishes 57 computer publications in more than 20 major countries. Nine million people read one or more of the group's publications each month. Members of the group include: Argentina's *Computerworld/Argentina;* Asia's *The Asian Computerworld;* Australia's *Computerworld Australia, Australian PC World, Macworld* and *Directories;* Brazil's *DataNews* and *MicroMundo;* China's *China Computerworld;* Denmark's *Computerworld/Danmark, PC World* and *RUN* (Commodore); Finland's *Mikro;* France's *Le Monde Informatique, Golden* (Apple), *OPC* (IBM) and *Distributique;* Germany's *Computerwoche, Microcomputerwelt, PC Welt, SoftwareMarkt, CW Edition/Seminar, Computer Business, RUN* and *Apple's;* Italy's *Computerworld Italia* and *PC Magazine;* Japan's *Computerworld Japan;* Mexico's *Computerworld/Mexico* and *CompuMundo;* The Netherland's *Computerworld Benelux* and *PC World Benelux;* Norway's *Computerworld Norge, PC World* and *RUN* (Commodore); Saudi Arabia's *Saudi Computerworld;* Spain's *Computerworld Espana, Microsistemas/PC World, Commodore World;* Sweden's *ComputerSweden, Mikrodatorn* and *Svenska PC;* the UK's *Computer Management, Computer News, PC Business World* and *Computer Business Europe;* Venezuela's *Computerworld Venezuela;* the US's *Computerworld, Hot CoCo, InCider, Infoworld, MacWorld, Micro Marketworld, PC World, RUN, 73, 80 Micro, Focus Publications* and *On Communications.*

QRX. . .

EDITED BY PERRY DONHAM KW1O

Change-Up

BILLING IT AS THE BIGGEST CHANGE in its 65-year history, **Herb Nelson W9IGL** of the **Radio Amateur *Callbook*** has announced a new look for the 1986 edition. Published on December 1st, 1985, the new *North American Callbook* will list amateurs not only in the United States, but also those in Canada, Mexico, Central America, the Caribbean, and Greenland. Also published on December 1st, the 1986 *International Callbook* contains the call, name, and address of amateurs everywhere else. Both books include the *Callbook*'s "extras": international postal information, worldwide QSL bureaus, a census of hams, abbreviations, and so forth. A third publication, available June 1, 1986, is the *Callbook Supplement.* Instead of producing three supplements per year per *Callbook*, this single volume will be offered—it contains new licensees, address changes, and call changes for both the North American and the International editions. Anyone who has spent an hour digging through three supplements to find a new call will appreciate having everything in one book. The new format will also allow it to be sold through dealers, something that was difficult at best with the old supplements. It isn't too early to think about Christmas! You can get information about *Callbook* products by writing Radio Amateur Callbook, Inc., 925 Sherwood Drive Box 247, Lake Bluff IL 60044.

Free Passage

NASA IS LOOKING for a few good hams to participate in an experiment involving a geostationary satellite. Volunteers will be given free access for two years to the transponder, which has an uplink of 28–30 GHz and a downlink of 18–20 GHz; the bird is scheduled for launch in 1989. You'll need a ten-foot dish and an "expression of intent" on file with NASA to play. Complete details are contained in a brochure available from Ron Schertler, MS54-6, NASA Louis Research Center, Cleveland OH 44135.

What A Guy!

A SECRET CONTEST has been running on the *73* computer bulletin board—we've been looking for the 1000th caller. And the winner is (drum roll): **Jean Faguy VE2AKJ** of Quebec city. Jean unwittingly won himself a one-year subscription to his favorite ham rag. *73*, of course! The RBBS is rapidly closing in on caller number 2000, and with good reason. On it you can find scads of software for your microcomputer, current news including electronic editions of the *W5YI Report* and *The ARRL Letter*, DX news, bulletins, and plenty of people to talk to via the personal mail system. You can even submit your latest article for consideration, or tell the staff how wonderful you think we are! The number is (603)-924-9809, 300 or 1200 baud. Send a carriage return or two to get things rolling.

Empty Shelves

AN AMAZING THING HAPPENED in Derry, New Hampshire. Hundreds of rabid hams waving fistfuls of money converged on **Rivendell Electronics** during what looked like a run on the bank. The occasion? **ICOM Day!** I caught up with **Evelyn Garrison KA7LPK** of ICOM; from the throng surrounding her I thought perhaps she was giving away IC-02ATs as party favors. Alas, there were no freebies, and Evelyn was standing in front of an empty table—a table which had held stacks of ICOM HTs and low-band rigs (including the new IC-735—review next month). She recounted the story of one fellow who had driven 600 miles just to get a deal on his favorite rig! He went home happy. Standing next to Evelyn were **George N7EZJ and Annie Buxton** of AEA, demonstrating their new software to an enraptured crowd. Short ad: Look next month for a new packet-radio controller from AEA for the Commodore 64. It will be a plug-in module that includes a software-selectable HF or VHF modem, a menu-driven terminal program, and a hardware HDLC. Just run a cable from the cartridge to your radio and you're on packet! Don't miss ICOM Day at your local dealer—tell him *73* sent you.

Think Space!

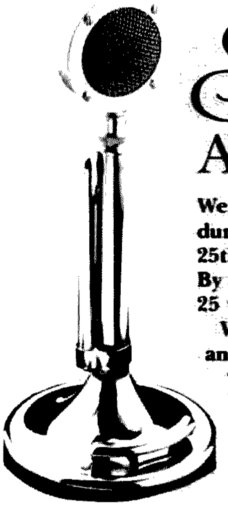
WHAT DO YOU THINK the United States should be doing in space? The **National Space Institute** has launched **Space Outreach '85**, a program designed to solicit ideas from the general public as to potential uses of space for social and economic benefit. The rules are pretty simple. Suggestions may be no longer than 750 words. You should not submit scientific or exploration projects such as a moon base or a Mars mission, since these ideas are already being looked at by the government. And your proposal should be creative, innovative, and feasible. Each entry will be reviewed by a panel of judges which includes Walter Boyne, Director of the Smithsonian's National Air and Space Museum, Evert Clark, Technology Editor of *Business Week*, former astronaut Michael Collins, and Robert Cowen, science writer for *The Christian Science Monitor*. Outstanding submissions will be acknowledged with an award, and the person who submits the best idea will receive an all-expense-paid trip to see a space-shuttle launch. All of the proposals submitted will be compiled and presented to Congress, NASA, and the newly-created National Commission on Space. To get more information on Space Outreach '85, or to send in an idea, contact The National Space Institute, West Wing #203, 600 Maryland Ave SW, Washington DC 20024; (202)-484-1111. The deadline for entries is November 15, 1985.

Smilin' Island

THE ARRL's DX ADVISORY COMMITTEE has voted to add the **Pribilof Islands** to the DXCC country list. The ten-year effort to put KL7/P on the list boiled down to one issue: While the Pribilofs are 260 miles away from mainland Alaska, they are only 200 miles from the Aleutian Islands. Does "separation by water" apply in this case? In a document titled "Guidelines for Interpreting the DXCC Country Criteria," paragraph 2.6(b) states, "Islands. . .which are geographically located adjacent to an island or island group which have a common government will be considered as separate entities provided there is at least 500 miles of open water separation between the two areas in question." This seems to say that the Pribilofs do *not* qualify for DXCC country status. But given the seemingly willy-nilly method of filling the DXCC list used in the past, it will come as no surprise if the ARRL Awards Committee votes to accept the DXAC's recommendation.

Stringers

AS ALWAYS, we had help in putting "QRX" together. This month it came from the *W5YI Report, The ARRL Letter, Westlink*, N2BFG, W1QMS, *Amateur Satellite Report*, Charles Kelsey, and Tony Reichardt. Don't forget to send your news items to *73* Magazine, Editorial Department, 80 Pine Street, Peterborough NH 03458, Attn: "QRX."



Silver Eagle AWARDS

We wanted to do something special in this issue to recognize some special people who have made *73* possible during the past 25 years, so in February we started sending out quiet feelers to longtime observers. "Our 25th Anniversary issue is coming up in October—name a name." By the middle of June, we had 98 nominees. By the first week of July, we had gotten the list down to 37 finalists. By the end of July, we had chosen the 25 winners of Silver Eagle mikes made by Astatic.

What are the criteria? We don't know, even though they've been discussed for months. "For service above and beyond the call of duty." "Outstanding contributions to *73*." "For helping *73*." "Continuous loyalty." "Excellent quality of work." "A care." None of these descriptions covers everyone, though, so here's the official reason why we recognize the Silver Eagle winners: "Because we want to."

These people are *73*'s 25th Anniversary all-stars. They're special. Some are hams and some aren't. Some can put a Silver Eagle to use and some can't. Two are Silent Keys. So what? *73* doesn't forget. We are very proud of all of them.—Eds.

Bill Pasternak WA6ITF. Part of the original "Brooklyn gang" which helped *73* at its birth. Longtime Looking West columnist (1973–1981). Patron of repeaters and repeater coordination. Lives and breathes amateur radio. Champion of *Westlink*. Once was being paid $12 a month and offered to work for less. No publication anywhere—ever—has had a finer friend. (Our continuing thanks, Sharon, for putting up with him.) (1962–Present)

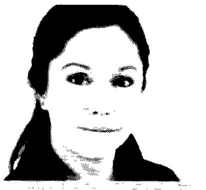
Knud Keller KV4GG/1. An honest, class, crazy guy. His careful accounting kept *73* in business more than once. Ex-player at Caribbean piano bars. Wore out more than one adding machine. Always positive. (1973–1984)

Bill Morello. One of the great unsung electronics draftsmen in the United States. Combines great technical skill with a degree in electrical engineering. Impeccable products. Has stuck with *73* through thick and thin. Now heads Techart Associates in Amherst, New Hampshire. Has had more pages of his work published during *73*'s first 25 years than any other contributor, including Wayne. (1969–Present)

Virginia Londner. Involved with *73* in the early days. Returned to help save it in the mid-1970s. Hyper-energy. Responsible for hiring many key people during critical, crucial times. (1960–1964, 1974–1976)

Barbara Walker Latti. Head of our typesetting department when she *was* our typesetting department. Fierce. Dedicated to quality and quality only. Worked with Stone-Age systems. Loved by all. (1974–1982)

Jim Allen N4DEE, Columbia SC. A randomly-selected recent letter-writer. Represents more than 61,000 others, minimum, as best we can conservatively estimate.



Nancy Salmon. Intense and overly department-defensive. Hard worker. Charged with the impossible task of organizing and administrating the dramatic changes in our burgeoning production efforts of the early 1980s. Successfully did it. Quietly nominated by former frontline antagonists who said, basically, separately, "We should think about Nancy Salmon." (1979–1984)

Bill Heydolph. Produced high-quality commercial photography—for years, always—under primitive conditions not believable. Leapt from horizontal to vertical shooting. Always willing to stay late or do whatever it took to get things done—with a "yes" and a tired smile. Once had an assistant who put a road-kill bird in his sandwich as a measure of respect and way of keeping his senses going one more day. (1974–1982)

Marc Leavey WA3AJR. Mr. RTTY Loop. Gone out of his way many times to encourage *73* to help spread the gospel. Was micro'd before it counted. Loves strange queries from readers. Otherwise, regular semi-normal TTY fanatic. (1977–Present)

Bandel Linn K4PP. Permanent artist and gadfly. Has had his work appear in every important issue of *73*, starting with #1. Signs his letters with "The Great Linn." (1960–Present)

Eric Shalkhauser W9CI (1893–1983). Recorder of events. Saver of evidence. Carer for making sure hams would see it. Excellent, wandering writer. Author of "The History of Ham Radio" series in *73* (1977–Future), originally published in the *QCC News*. Still owes Lee Knirko W9MOL for shepherding his work. Known to and remembered by all as "Shaw." (1977–Future)

Dave Ingram K4TWJ. SSTV columnist (1972–1982) and aficionado when no one even cared except *73*. Prolific author. Well-known for single-spaced manuscripts with typos. A servant of scores of thousands of hams. (1972–1982)

Bob Baker WB2GFE, ex-WA1SCX. Founder of *73*'s modern-day Contests column. Famous for always being on time and for always sending the cleanest copy. Has been known to associate with microcomputers. (1975–Present)

Jim Joyce VK3YJ. Represents our *73* International correspondents. Since 1983, we have had more than 60 people send more than 1000 columns, sometimes at personal risk. (1983–Present)

Bill Barry. One of the award-winners everyone who has ever worked at *73* loves. Basically a mailroom operative and roving spirit-keeper-upper. Saved canceled stamps for nuns. Started working in the 1930s as a caretaker at what would later become our Pine Street building. Modest, successful lightweight amateur fighter. Set world record in 1980 by wearing long-johns more than 42 weeks a year for five consecutive years. (1973–1983)

Lynn Panciera-Fraser. Never would settle for less than the best. Would and did back up words with action by spending many long nights at the light table, at doing and checking paste-up, at showing that the impossible could be done. Respected before she left, revered after. Instigator of a corporate vegetable garden. (1972–1979)

Peter Stark K2OAW. Outstanding long-term author and consultant. One of the first in ham radio to recognize and grasp the link with computers and its possibilities. Equally adept at writing about theory or construction. Possibly brilliant. (1973–Present)

Bill Gosney KE7C. Awards columnist for six years. Founder of *73*'s award-certificate programs. Originator and coordinator of *73*'s World SSB Contests. Knows a little about IRCs. Puts international operations together with fake apparent ease. (1979–Present)

Robert Reed WB2DIN, Wantagh NY. Represents our lifetime subscribers. Like many others, put his money where Wayne's mouth was. (1978–Present)

Randy Peckenpaugh WB0SMX, Garden City KS. Represents every one of our new subscribers over the years. Signed up this summer. We thank you all—very much—every day. (1985–Present)

John Nelson (1903–1984). "This is Nelson. Tell people I see some flares tomorrow and Friday. Things look good for 20." John, our readers have had this issue in their hands for two weeks. "And I think something's happening next Wednesday, too!" We checked. It did. Our beloved, amazing Propagation Wizard. (1963–1984)

Bill Hoisington K1CLL. One of the fathers of esoteric, fun building, particularly for six meters. Assumed you know more than you do. Assumed you could get the parts he could. Made you think in order to enjoy. (1963–1975)

Ed Ferman WA1UFY. With an obnoxious-to-many flair, brought high-tech state-of-the-art production techniques to Peterborough. "We can do this stuff ourselves—why farm it out?" (1980–1982)

Sherry Smythe. Canny, bizarre, but genuinely big-hearted. Contributed to *73* by going out of her way to try different marketing procedures. Well-known for being a hard-core businesswoman. Widely respected for taking a sincere personal interest in the personal interests of employees. A surprise nominee/survivor of the Eagle elimination process. (1976–1983)

Dotty Gibson. One-person effective circulation department for years. One-person stand-up-and-browbeat-Wayne department for years, if something was wrong. One-person do-everything department, carefully and nicely. A finer lady doesn't exist. (1966–1980)

Talk Is Cheap

Good news: Now you can afford a speech synthesizer! You have our word on it.

Thomas C. Johnson WB6NQK
2056 E. Sutter Pl.
Oxnard CA 93033

It wasn't too long ago that speech synthesis was nothing but science fiction. Now, due to technological advances in the large-scale integration industry and speech analysis, it has become possible to put a complete voice synthesizer on one integrated-circuit chip. Several manufacturers have come out with single-chip synthesizers. Votrax has come out with the SC-01, Silicon Systems, Inc., has come out with the SSI263, and Radio Shack is selling the General Instruments SPO256 Narrator chip.

What these chips have in common is that they do not store just a limited vocabulary of preformed words—they contain the individual sounds that make up every spoken English word. This means that with the proper selection of these parts of speech, any word can be formed by the chip.

I selected the SPO256 chip from Radio Shack because it was only $12.95; the others were in the $60–$80 range. The chip can be found at most Radio Shack stores as part no. 276-1784. When you look for this chip, make sure you do not get it confused with part no. 276-1783. This also is a voice-synthesizer chip, but it uses an external ROM chip to produce 36 words. It also does not come with the comprehensive technical data booklet which accompanies part no. 276-1784. The chip included in 276-1784 will have SPO256-AL2 stamped on it.

Speech Synthesis Basics

There are 3 major techniques used to synthesize the human voice. These are formant synthesis, linear-predictive coding (LPC), and waveform digitization.

Formant synthesis is the electronic modeling of the natural resonances of the vocal tract. The vocal spectrum is formed of bands of resonant frequencies which are called formants. These are generated electronically and passed through variable filters.

One variation of formant synthesis is known as phoneme synthesis. This technique derives the spectral parameters from basic sound units which make up

		Labial	Labio-Dental	Inter-Dental	Alveolar	Palatal	Velar	Glottal
Stops:	Voiceless	PP			TT		KK	
	Voiced	BB			DD		GG	
Fricatives:	Voiceless	WH	FF	TH	SS	SH		HH
	Voiced		VV	DH	ZZ	ZH*		
Affricates:	Voiceless					CH		
	Voiced					JH		
Nasals	Voiced	MM			NN		NG*	
Resonants	Voiced	WW			RR, LL	YY		

* These do not occur in word-initial position in English.

Labial: Upper and lower lips touch or approximate.
Labio-Dental: Upper teeth and lower lip touch.
Inter-Dental: Tongue between teeth.
Alveolar: Tip of tongue touches or approximates alveolar ridge (just behind upper teeth).
Palatal: Body of tongue approximates palate (roof of mouth).
Velar: Body of tongue touches velum (posterior portion of roof of mouth).
Glottal: Glottis (opening between vocal cords).

Fig. 1. Consonant phonemes of English.

	Front	Central	Back
High	YR		
	IY		UW#
	IH*		UH*#
Mid	EY	ER	OW#
	EH*	AX*	OY#
	XR		
Low	AE*	AW#	AO*#
		AY	OR#
		AR	
		AA*	

* Short Vowels
\# Rounded Vowels

Fig. 2. Vowel phonemes of English.

```
0000                  PAG
0000            ;
0000            ******************************
0000            *       CHEAP-TALKER         *
0000            *    DRIVER SOFTWARE FOR     *
0000            * SPO-256 VOICE SYNTHESIZER  *
0000            *   BY THOMAS C. JOHNSON     *
0000            *          WB6NOF            *
0000            *       DEC 7, 1984          *
0000            ******************************
0000            ;
0300                  ORG $300
0300            ;
0300            ;
C08E            PIADPRB  EQU $C08E+$30     ; SLOT 3 DATA DIRECTION AND OUTPUT BUFFER
C08F            PIACRB   EQU $C08F+$30     ; SLOT 3 CONTROL REGISTER
0340            SOUNDS   EQU $340          ; ALLOPHONE BUFFER- $340 CONTAINS NO. OF ALLOPHONES TO FOLLOW
0300            ;                          ; $341-$3CF CONTAIN THE ALLOPHONES TO BE SPOKEN
0300            ;
0300            ;
0300            INIT:
0300 A9 00                LDA #0
0302 8D BF C0             STA PIACRB        ; ENABLE DATA DIRECTION REGISTER
0305 A9 3F                LDA #$3F
0307 8D BE C0             STA PIADPRB       ; BITS 0-5=OUTPUTS, BITS 6-7 INPUTS
030A A9 2C                LDA #$2C
030C 8D BF C0             STA PIACRB        ; CB2 IN PULSE MODE
030F            ;
030F            ;
030F            SPEAK:
030F A2 00                LDX #0
0311 BD 40 03             LDA SOUNDS,X      ; LOAD THE NUMBER OF ALLOPHONES TO SPEAK
0314 A8                   TAY               ; USE Y REG TO COUNT
0315 E8                   INX               ; USE X REG TO POINT TO NEXT ALLOPHONE
0316 BD 40 03   ^1        LDA SOUNDS,X      ; LOAD THE NEXT ALLOPHONE
0319 20 26 03             JSR PRONOUNC      ; SEND IT TO THE SYNTHESIZER
031C E8                   INX               ; MOVE POINTER TO NEXT ALLOPHONE
031D 88                   DEY               ; DECREMENT THE COUNTER...ALL DONE YET?
031E D0 F6                BNE <1            ; NO, DO THE NEXT ONE
0320 A9 00                LDA #0            ; YES, SEND A PA1 TO THE SYNTHESIZER TO END THE WORD
0322 20 26 03             JSR PRONOUNC      ; SEND IT
0325 60                   RTS               ; DONE
0326            ;
0326            PRONOUNC:
0326 48                   PHA               ; HOLD DATA ON STACK
0327 AD BE C0   ^1        LDA PIADPRB       ; SYNTHESIZER READY FOR NEW DATA YET?
032A 30 FB                BMI <1            ; NO, CHECK AGAIN
032C 68                   PLA               ; YES, GET THE DATA
032D 8D BE C0             STA PIADPRB       ; SEND IT TO THE SYNTHESIZER
0330 60                   RTS
0331            ;
0331                      END
```

Listing 1. Synthesizer-driver source code.

English words, called phonemes. Each phoneme is given a numeric code and the synthesizer circuit generates these sounds when given the codes. A word is formed by stringing various phoneme codes together. As will be seen, the SPO256 chip uses a variation of phoneme synthesis called allophone synthesis.

Linear-predictive coding is similar to the formant-synthesis technique because it also is based on the frequencies found in human speech and uses similar hardware to simulate the vocal tract. The difference is that LPC uses stored filter coefficients, excitation frequencies, and amplifier gain settings. The name LPC refers to the programmed activities of the multistage lattice filters which produce the desired bands of resonant frequencies.

Waveform digitization is a technique which digitally records speech and then plays it back when desired. The speech is sampled by a D/A converter and stored. Then, when the sounds are to be spoken, the digital data is sent to an A/D converter and a low-pass filter. All the original inflections and intonations are intact, but the process requires large volumes of storage space to hold a vocabulary of any usable size.

In the case of allophone synthesis, which is what this project involves, when dealing with human speech and English text relationships, it is important to remember three things. First of all, there is no one-to-one relationship between the individual sounds which make up a word and the individual letters which make up the text of the word. Second, speech sounds are acoustically different depending on the position they hold in a word. And third, the same individual sound may be perceived differently by the ear, depending on the relationship it holds with different sounds.

As mentioned before, the individual sounds which make up spoken words are called phonemes. Each language has a set which differs in some ways from that of other languages. Fig. 1

Allophone	Dec	Hex	Guidelines
SILENCE			
PA1	00	00	Before BB, DD, GG, and JH
PA2	01	01	Before BB, DD, GG, and JH
PA3	02	02	Before PP, TT, KK, CH; between words
PA4	03	03	Between clauses and sentences
PA5	04	04	Between clauses and sentences
SHORT VOWELS			
IH *	12	0C	sItting, strandEd
EH *	07	07	extEnt, mEn
AE *	26	1A	Acting, cAt
UH *	30	1E	cOOkie, bOOk
AO *	23	17	tAlking, sOng
AX *	15	0F	dUck, instrUct
AA *	24	18	pOttery, cOt
LONG VOWELS			
IY	19	13	trEAt, pEEk
EY	20	14	skAte, grEAt
AY	06	06	kIte, skY
OY	05	05	nOIse, tOY
UW1	22	16	after clusters with YY: compUter
UW2	31	1F	in monosyllabic words: twO, fOOd
OW	53	35	zOne, clOse
AW	32	20	sOUnd, dOWn
EL	62	3E	littLE, gentLE
R-COLORED WORDS			
ER1	52	34	lettER, fURnitURe
ER2	53	35	monosyllables: bIRd, fERn
OR	58	3A	fORtune, stORe
AR	59	3B	fARm, alARm
YR	60	3C	hEAR, IRresponsible
XR	47	2F	hAIR, stARe
RESONANTS			
WW	46	2E	We, Warrant
RR1	14	0E	initial position: Read, wRite
RR2	39	27	initial clusters: bRown, cRane
LL	45	2D	Like, heLLo
YY1	49	31	clusters: cUte, compUter
YY2	25	19	initial position: Yes, Yarn
VOICED FRICATIVES			
VV	35	23	Vest, proVe
DH1	18	12	word-initial position: THis, THey
DH2	54	36	word-final and between vowels: baTHe, baTHing
ZZ	43	2B	Zoo, phaSe
ZH	38	26	beiGE, pleaSure
VOICELESS FRICATIVES			
FF *	40	28	these may be doubled for
TH *	29	1D	initial position and singled
SS *	55	37	for middle or final position.
SH	37	25	SHirt, leaSH
HH1	27	1B	before front vowels: YR, IY, IH, EY, EH, XR, AE
HH2	57	39	before back vowels: UW,UH, OW, OY, AO, OR, AR
WH	48	30	WHite, WHim
VOICED STOPS			
BB1	28	1C	final position: riB; between vowels: fiBBer; in clusters: Bleed, Brown
BB2	63	3F	initial position before a vowel: Beast
DD1	21	15	final position: playeD
DD2	33	21	initial position: Down; clusters: Drain
GG1	36	24	before high front vowels: YR, IY,IH,EY, EH,XR
GG2	61	3D	before high back vowels:UW,UH,OW,OY,AX; and clusters: Green, Glue
GG3	34	22	before low vowels: AE, AW, AY, ,AR, AA, AO, OR, ER; and medial clusters: anGer; and final position: peG
VOICELESS STOPS			
PP	09	09	Pleasure, amPle
TT1	17	11	final clusters before (ts): iTs, neTs
TT2	13	0D	all other positions: Table, TargeT
KK1	42	2A	before front vowels: YR, IY, IH, EY, EH, XR, AY, AE, ER, AX; initial clusters: Cute, Clown
KK2	41	29	final position: speaK, final clusters: tasK
KK3	08	08	before back vowels: UW, UH, OW, OY, OR, AR, AO; initial clusters: Crane, Quick
AFFRICATES			
CH	50	32	CHurCH, feaTure
JH	10	0A	inJure, eDGe
NASAL			
MM	16	10	MilK, alarM
NN1	11	0B	before front and central vowels: YR, IY, IH, EY, EH, XR, AE, ER, AX, AW, AY, UW; final clusters: earN
NN2	56	38	before back vowels: UH, OW, OY, OR, AR, AA
NG	44	2C	striNG, aNger

* These allophones can be doubled. (One after the other with no pause between them.)

Fig. 3. Allophone guidelines.

shows the consonant phonemes of English and Fig. 2 shows the vowel phonemes of English. Phonemes are acoustically different depending on their location in a word. Each acoustic variation of a phoneme based on its position is an *allophone* of the phoneme. Each allophone is a different manifestation of a basic phoneme and is the basis of speech synthesis in the SPO256 chip.

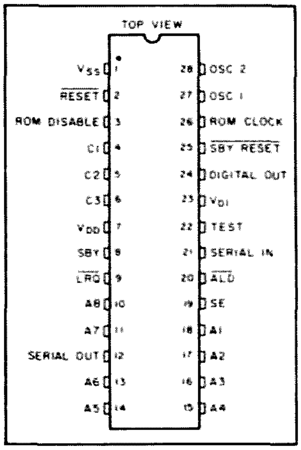


Fig. 4(a). Pin configuration.

The repertoire of sounds for the SPO256 is called the allophone set. It contains 59 allophones and 5 pauses of various lengths. These allophones, their associated codes, and examples of usage are shown in Fig. 3. In this table, the associated letter or letters in the example word are shown capitalized. Some phonemes have two or three allophones. These variations are position- and context-dependent, as indicated in the associated examples. For example, KK1 will sound good before LL as in "club," and KK2 will sound good before WW as in "squid." Remember, we are dealing with sounds, not letters. Some allophones sound better when preceded by a short length of silence, such as PP, BB, TT, DD, KK, GG, CH, and JH.

Project Construction

The SPO256 chip is shown with pinouts in Fig. 4(a) and the block diagram is shown in Fig. 5. The chip contains a software-programmable digital filter used to model the human vocal tract, an internal 16K ROM containing the allophone construction algorithm, a microcontroller, ALU, and a pulse-width modulator to generate the output sounds. It is possible to use an external ROM instead of the internal one to generate speech using custom LPC or formant-synthesis techniques, but I did not use this in this project. I used the internal ROM with the provided allophone set. The chip uses a single +5-V supply and is TTL-compatible.

Pin Number	Name	Function
1	Vss	Ground
2	RESET	A logic 0 resets that portion of the SP powered by VDD. Must be returned to a logic 1 for normal operation.
3	ROM DISABLE	For use with an external serial speech ROM, a logic 1 disables the external ROM.
4, 5, 6	C1, C2, C3	Output control lines for use with an external serial speech ROM. Refer to the SPR016 data sheet for details.
7	VDD	Power supply for all portions of the SP except the microprocessor interface logic.
8	SBY	STANDBY. A logic 1 output indicates that the SP is inactive and VDD can be powered down externally to conserve power. When the SP is reactivated by an address being loaded, SBY will go to a logic 0.
9	LRQ	LOAD REQUEST. LRQ is a logic 1 output whenever the input buffer is full. When LRQ goes to a logic 0, the input port may be loaded by placing the 8 address bits on A1–A8 and pulsing the ALD output.
10, 11, 13, 14, 15, 16, 17, 18	A8, A7, A6, A5, A4, A3, A2, A1	8-bit address which defines any one of 256 speech entry points.
12	SER OUT	SERIAL ADDRESS OUT. This output transfers a 16-bit address serially to an external speech ROM.
19	SE	STROBE ENABLE. Normally held in a logic 1 state. When tied to ground, ALD is disabled and the SP will automatically latch in the address on the input bus approximately 1 μs after detecting a logic 1 on any address line.
20	ALD	ADDRESS LOAD. A negative pulse on this input loads the 8 address bits into the input port. The negative edge of this pulse causes LRQ to go high.
21	SER IN	SERIAL IN. This is an 8-bit serial data input from an external speech ROM.
22	TEST	This pin should be grounded for normal operation.
23	VD1	Power supply for the microprocessor interface logic and controller.
24	DIGITAL OUT	Pulse-width-modulated digital-speech output which, when filtered by a 5-kHz low-pass filter and amplified, will drive a loudspeaker.
25	SBY RESET	STANDBY RESET. A logic 0 resets the microprocessor interface logic and the address latches. Must be returned to a logic 1 for normal operation.
26	ROM CLOCK	This is a 1.56-MHz clock output used to drive an external serial speech ROM.
27	OSC1	XTAL IN. Input connection for a 3.12-MHz crystal.
28	OSC2	XTAL OUT. Output connection for a 3.12-MHz crystal.

Fig. 4(b). Pin functions.

I constructed Cheap-Talker on a Vector Graphics wire-wrap prototype board. The circuit is so simple, however, that it would be *no* problem to hand etch a board using a good etch resist pen and some ferric chloride solution. Either way, there are no special design or layout considerations to be made, just good common electronic construction techniques.

The schematic for the circuit is shown in Fig. 6. I used an MC6821 parallel interface chip to interface the synthesizer chip to the Apple bus. I used this chip because I happened to have some left over from another project and I am familiar with its operation. Port B in the PIA is used to allow the use of the CB2 line for handshaking.

The synthesizer-chip design is such that it is possible to connect it directly to a Centronics-compatible parallel interface. The A1–A6 lines would be connected to the D1–D6 lines, the ALD pin would connect to the Data Strobe line, and the SBY pin would connect to the Busy line.

Software

The other beauty of this project is that no highly sophisticated software is required to make the chip work. The entire driver program and allophone buffer fits in just 208 bytes. The program alone is only 49 bytes. This is shown in Listing 1. This program, when called at location $300 (768 decimal), will send the allophone codes in the allophone buffer located in locations $341–$3CF (833–975 decimal) to the synthesizer one at a time. Location $340 (832 decimal) contains the number of allophones to

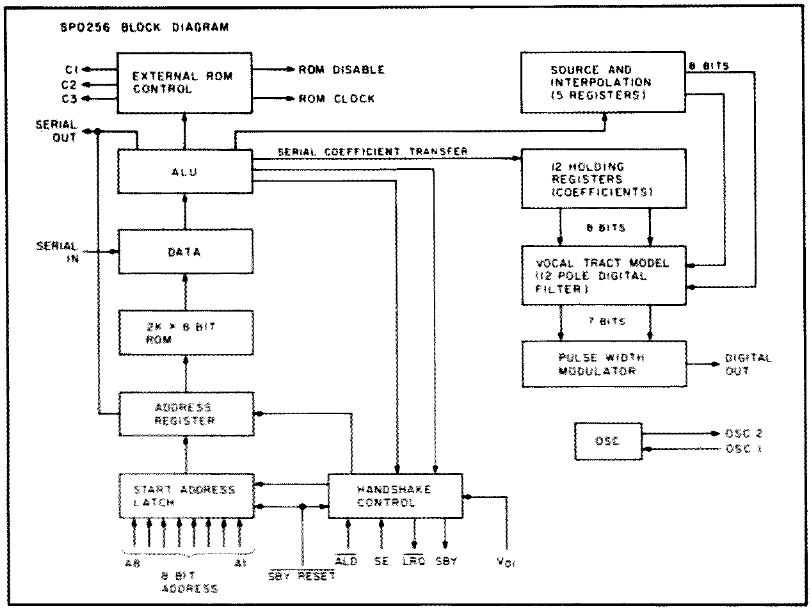


Fig. 5. SPO256 block diagram.

be sent. This allows 142 allophone codes to be sent to the synthesizer. This is more than enough for most messages composed of a number of words. Most words contain less than 20 allophone codes.

The INIT portion configures port B of the 6821 chip to have bits 0–5 in the output mode and bits 6–7 in the input mode. Bit 7 is used to monitor the LRQ (Load Request) pin on the synthesizer to find out when it is ready for another allophone. The CB2 pin on the 6821 is put in the "pulse on write" mode, which sends a negative pulse out when data is written into port B. This signals the synthesizer that the allophone data is ready. Please note that the addresses for the PIACRB (Control Register B) and PIADPRB (Data Direction and Peripheral Register B) registers are offset in lines 15 and 16 for use in slot 3 of the Apple. If you are using an assembler which uses similar nomenclature, you could change the slot by changing the $30 to $x0, where x is the slot number. If you are typing in the hexadecimal values for the program, you would change the $BF in locations $303 and $30D to $8F + $n0, where n is the slot number. You would also change the $BE in locations $308, $328, and, $32E to $8E + $n0.

The SPEAK routine takes the allophones and sends them to the synthesizer via the PRONOUNC routine. SPEAK uses the value in location $340 to initialize the Y register as a counter to keep track of the number of allophones sent. The X register is used as a pointer to the various values in the allophone buffer.

The PRONOUNC routine saves the allophone data in the accumulator on the stack while it checks the LRQ line to see if the synthesizer is ready for the next allophone. It does this by reading the value in bit 7 of Peripheral Register B which, as was mentioned earlier, is set up as an input. If bit 7 is a 0, then the synthesizer is ready to receive data via Peripheral Register B.

Right now you might be wondering how to get the proper allophone codes put into the buffer to get the thing to say what you want it to. There are basically two ways to do this. One is to create a dictionary of words with the associated allophone codes needed to generate each word. Then, by selecting the desired word, the appropriate allophone codes can be loaded into the buffer and spoken. The other method would be to utilize some sort of text-to-allophone algorithm which would analyze a word and generate the proper allophone codes to speak the word.

The dictionary method is by far a simpler method, but it has two drawbacks. First of all, the memory required to have enough words in the dictionary to speak all of the most-used words in the English language would be above the capabilities of most microcomputers. The second disadvantage is the large amount of time which needs to be invested in order to create the dictionary.

The text-to-allophone algorithm is by far the best in terms of flexibility and economy of memory. All that is necessary to use it is to send the word text to the algo-

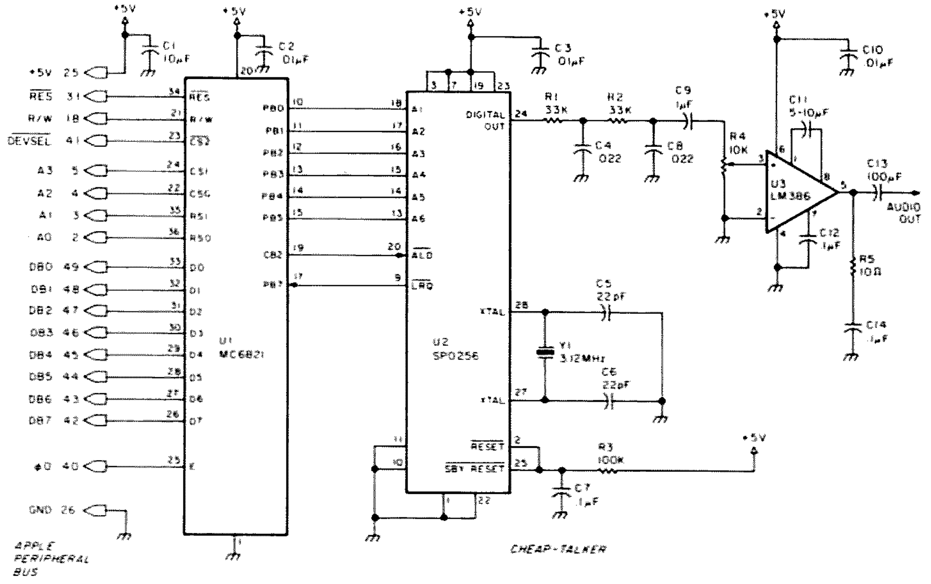


Fig. 6. Schematic.

```
1   REM  **********************************
2   REM  * CHEAP-TALKER VOICE SYNTHESIZER *
3   REM  * BY THOMAS C. JOHNSON  WB6NOK   *
4   REM  **********************************
5 D$ =  CHR$ (4)
1Ø  DIM M%(1ØØ,16)
15  REM      MESSAGE ARRAY: 1ØØ MESSAGES W/ 16 WORDS EACH
2Ø  DIM W%(2ØØ,32)
25  REM      DICTIONARY CODES: 199 WORDS W/32 ALLOPHONES PER WORD/W%(Ø,Ø)=#
     OF WORDS IN FILE/W%(W,Ø)=#OF ALLOPHONES FOR WORD X
3Ø  DIM W$(2ØØ): REM   DICTIONARY TEXT
5Ø  DIM AL$(63): REM  ALLOPHONE TEXT
6Ø  DATA PA1,PA2,PA3,PA4,PA5,OY,AY,EH,KK3,PP,JH,NN1,IH,TT2,RR1,AX,MM,TT1,D
     H1,IY,EY,DD1,UW1,AO,AA,YY2,AE,HH1,BB1,TH,UH,UW2
7Ø  DATA AW,DD2,GG3,VV,GG1,SH,ZH,RR2,FF,KK2,KK1,ZZ,NG,LL,WW,XR,WH,YY1,CH,E
     R1,ER2,OW,DH2,SS,NN2,HH2,OR,AR,YR,GG2,EL,BB2
8Ø  FOR I = Ø TO 63: READ AL$(I): NEXT
9Ø  GOSUB 9ØØ
99  GOTO 1ØØØ
1ØØ  REM  READ DICTIONARY FILE
11Ø  PRINT D$;"OPEN ";DF$
12Ø  PRINT D$;"READ ";DF$
13Ø  INPUT W%(Ø,Ø):J = W%(Ø,Ø)
135  IF J = Ø THEN 17Ø
14Ø  FOR I = 1 TO J: INPUT W%(I,Ø):L = W%(I,Ø): REM  INPUT A WORD. J IS #
     OF WORDS
15Ø  FOR K = 1 TO L: INPUT W%(I,K): NEXT : REM  INPUT ALLOPHONE CODES. L I
     S # OF CODES
16Ø  NEXT I
17Ø  PRINT D$;"CLOSE"
18Ø  RETURN

2ØØ  REM  WRITE DICTIONARY FILE (DF$ IS FILE NAME)
21Ø  PRINT D$;"OPEN ";DF$
22Ø  PRINT D$;"WRITE";DF$
23Ø  PRINT W%(Ø,Ø):J = W%(Ø,Ø)
24Ø  FOR I = 1 TO J: PRINT W%(I,Ø):L = W%(I,Ø): REM   WRITE A WORD. J IS #
      OF WORDS
25Ø  FOR K = 1 TO L: PRINT W%(I,K): NEXT : REM   WRITE ALLOPHONE CODES. L
     IS # OF CODES
26Ø  NEXT I
27Ø  PRINT D$;"CLOSE"
28Ø  RETURN

3ØØ  REM  READ MESSAGE FILE (MF$ IS FILE NAME)
31Ø  PRINT D$;"OPEN ";MF$
32Ø  PRINT D$;"READ ";MF$
33Ø  INPUT M%(Ø,Ø):L = M%(Ø,Ø): REM   INPUT # OF MESSAGES
335  IF L = Ø THEN 37Ø
34Ø  FOR I = 1 TO L: INPUT M%(I,Ø):M = M%(I,Ø): REM  INPUT MESSAGE. M=# OF
      WORDS IN MESSAGE
35Ø  FOR J = I TO M: INPUT M%(I,J): NEXT : REM   INPUT WORD CODES
36Ø  NEXT
37Ø  PRINT D$;"CLOSE"
38Ø  RETURN

4ØØ  REM  WRITE MESSAGE FILE (MF$ IS FILE NAME)
41Ø  PRINT D$;"OPEN ";MF$
42Ø  PRINT D$;"WRITE";MF$
43Ø  PRINT M%(Ø,Ø):L = M%(Ø,Ø): REM   PRINT # OF MESSAGES
44Ø  FOR I = 1 TO L: PRINT M%(I,Ø):M = M%(I,Ø): REM   WRITE MESSAGE. M=# O
     F WORDS IN MESSAGE
45Ø  FOR J = 1 TO M: PRINT M%(I,J): NEXT : REM     WRITE WORD CODES
46Ø  NEXT
47Ø  PRINT D$;"CLOSE"
48Ø  RETURN
5ØØ  REM  READ WORD TEXT FILE (WF$ IS FILE NAME)
5Ø5  IF W%(Ø,Ø) = Ø THEN  RETURN
51Ø  PRINT D$;"OPEN ";WF$
52Ø  PRINT D$;"READ ";WF$
53Ø  FOR I = 1 TO W%(Ø,Ø): INPUT W$(I): NEXT
54Ø  PRINT D$;"CLOSE"
55Ø  RETURN
6ØØ  REM  WRITE WORD TEXT FILE (WF$ IS FILE NAME)
61Ø  PRINT D$;"OPEN ";WF$
62Ø  PRINT D$;"WRITE ";WF$
63Ø  FOR I = I TO W%(Ø,Ø): PRINT W$(I): NEXT
64Ø  PRINT D$;"CLOSE"
65Ø  RETURN

7ØØ  REM  ENTER ALLOPHONE CODES
7Ø3 CR = 1
7Ø5  REM  W=CURRENT WORD
71Ø A = 1: REM  ALLOPHONE POINTER
72Ø  PRINT "PRESS RETURN TO TERMINATE ";A$
73Ø  INPUT "ENTER ALLOPHONE: ";A$: IF A$ = "" THEN 77Ø
74Ø  GOSUB 78Ø: IF X = 64 THEN  PRINT "INVALID ALLOPHONE...REENTER": GOTO
     73Ø
75Ø W%(W,A) = X:A = A + 1: IF A > 32 THEN W%(W,Ø) = 32:W%(W,A - I) = 2: RETURN

76Ø  GOTO 73Ø
77Ø W%(W,Ø) = A - I: RETURN
78Ø  FOR X = Ø TO 63: IF A$ = AL$(X) THEN  RETURN
79Ø  NEXT : RETURN
8ØØ  REM  FORM A MESSAGE
8Ø3 CR = I
8Ø5  REM  M IS MESSAGE NO.
81Ø X = 1: REM  WORD POINTER
815  PRINT "PRESS RETURN TO TERMINATE MESSAGE # ";M
82Ø  INPUT "ENTER WORD: ";A$: IF A$ = "" AND X <  > 1 THEN M%(M,Ø) = X - 1
     : RETURN

825  IF A$ = "" AND X = 1 THEN 82Ø
83Ø  GOSUB 86Ø: IF Z > W%(Ø,Ø) THEN  PRINT "WORD NOT IN DICT.": GOTO 82Ø
84Ø M%(M,X) = Z:X = X + 1: IF X > 16 THEN M%(M,Ø) = 16: RETURN
85Ø  GOTO 82Ø
86Ø  FOR Z = 1 TO W%(Ø,Ø): IF A$ = W$(Z) THEN  RETURN
87Ø  NEXT : RETURN
9ØØ  REM  OPEN FILES
91Ø  HOME : PRINT  TAB( 1Ø)"CHEAP-TALKER EDITOR"
92Ø  VTAB 5: INPUT "ENTER DICTIONARY NAME: ";A$: IF A$ = "" THEN A$ = "WOR
     DS"
93Ø DF$ = A$ + ".COD":WF$ = A$ + ".TXT"
94Ø  VTAB 7: INPUT "ENTER MESSAGE FILE NAME: ";A$: IF A$ = "" THEN A$ = "M
     ESSAGES"
95Ø MF$ = A$ + ".COD": GOSUB 1ØØ: GOSUB 3ØØ: GOSUB 5ØØ

96Ø  RETURN
1ØØØ  REM  MENU
1ØØ5  PRINT D$;"NOMONC,I,O": POKE 33,4Ø
1Ø1Ø  HOME : PRINT  TAB( 5)"CHEAP-TALKER EDITOR"
1Ø2Ø  VTAB 5: HTAB 15: PRINT "OPTIONS:"
1Ø3Ø  VTAB 7: PRINT  TAB( 5)"1> ENTER NEW WORDS TO DICTIONARY"
1Ø4Ø  PRINT  TAB( 5)"2> VIEW/CHANGE A WORD"
1Ø45  PRINT  TAB( 5)"3> DELETE A WORD"
1Ø5Ø  PRINT  TAB( 5)"4> PRINT DICTIONARY"
1Ø6Ø  PRINT  TAB( 5)"5> CREATE MESSAGES"
1Ø7Ø  PRINT  TAB( 5)"6> VIEW/CHANGE A MESSAGE"
1Ø75  PRINT  TAB( 5)"7> DELETE A MESSAGE"
1Ø8Ø  PRINT  TAB( 5)"8> PRINT MESSAGES"
1Ø9Ø  PRINT  TAB( 5)"9> SPEAK MESSAGES"
1Ø95  PRINT  TAB( 4)"1Ø> QUIT"
11ØØ  VTAB 2Ø: HTAB 1Ø: INPUT "ENTER CHOICE => ";A$: IF A$ = "" THEN 11ØØ
111Ø A =  VAL (A$): IF A < 1 OR A > 1Ø THEN 11ØØ
112Ø  ON A GOSUB 2ØØØ,3ØØØ,35ØØ,4ØØØ,5ØØØ,6ØØØ,65ØØ,7ØØØ,8ØØØ,114Ø
113Ø  GOTO 1ØØØ
114Ø  GOSUB 2ØØ: GOSUB 4ØØ: GOSUB 6ØØ: END
2ØØØ  REM  ENTER WORDS IN DICTIONARY
2ØØ3  HOME : PRINT  TAB( 1Ø)"ENTER NEW WORDS"
2ØØ5 W = W%(Ø,Ø)
2Ø1Ø  INPUT "ENTER WORD TEXT: ";A$: IF A$ = "" THEN  RETURN
2Ø15  GOSUB 86Ø: IF Z <  = W%(Ø,Ø) THEN  PRINT "WORD ALREADY IN DICT.": GOTO
     2Ø1Ø
2Ø2Ø  PRINT A$;" CORRECT ";: INPUT X$: IF X$ = "N" THEN 2Ø1Ø
2Ø25 W = W + 1: IF W <  = 3ØØ THEN W%(Ø,Ø) = W
2Ø3Ø W$(W) = A$
2Ø4Ø  GOSUB 7ØØ
2Ø5Ø  GOTO 2Ø1Ø
2Ø7Ø  RETURN
3ØØØ  REM  VIEW A WORD
3Ø1Ø  HOME : PRINT  TAB( 1Ø)"VIEW A WORD"
3Ø3Ø  VTAB 5: HTAB 5: INPUT "ENTER WORD TO VIEW: ";A$: IF A$ = "" THEN 3Ø3
     Ø
3Ø4Ø  GOSUB 86Ø: IF Z > W%(Ø,Ø) THEN  PRINT "WORD NOT IN DICT.": GOTO 3Ø3Ø

3Ø5Ø W = Z
3Ø6Ø  PRINT
3Ø7Ø  PRINT W$(W): FOR I = 1 TO W%(W,Ø): PRINT AL$(W%(W,I));"/";: NEXT I: PRINT

3Ø8Ø  PRINT
3Ø9Ø  INPUT "IS THIS WORD CORRECT Y/N";X$: IF X$ = "N" THEN  GOSUB 7ØØ: GOTO
     3Ø6Ø
31ØØ  INPUT "VIEW ANOTHER WORD? ";A$: IF A$ <  > "N" THEN 3Ø3Ø
311Ø  RETURN
35ØØ  REM  DELETE A WORD
35Ø5  IF W%(Ø,Ø) < 1 THEN  RETURN
351Ø  HOME : PRINT  TAB( 1Ø)"DELETE A WORD"
352Ø  VTAB 5: HTAB 5: INPUT "ENTER WORD TO DELETE: ";A$: IF A$ = "" THEN 3
     52Ø
353Ø  GOSUB 86Ø: IF Z > W%(Ø,Ø) THEN  PRINT "WORD NOT IN DICT.": GOTO 352Ø

354Ø W = Z: PRINT
355Ø  PRINT W$(W): FOR I = 1 TO W%(W,Ø): PRINT AL$(W%(W,I));"/";: NEXT : PRINT

356Ø  PRINT : INPUT "DELETE THIS WORD ";A$: IF A$ <  > "Y" THEN 358Ø
357Ø W$(W) = W$(W%(Ø,Ø)): FOR I = Ø TO W%(W%(Ø,Ø),Ø):W%(W,I) = W%(W%(Ø,Ø),
     I): NEXT :W%(Ø,Ø) = W%(Ø,Ø) - 1
358Ø  INPUT "DELETE ANOTHER? ";A$: IF A$ = "Y" THEN 35ØØ
359Ø  RETURN
4ØØØ  REM  PRINT DICTIONARY
4Ø1Ø  PRINT D$;"PR#1"
4Ø2Ø  PRINT  CHR$ (9)"135N"
4Ø25  PRINT  CHR$ (27);"N"; CHR$ (8);
4Ø3Ø  PRINT  CHR$ (14)"DICTIONARY FOR FILE ";DF$
4Ø4Ø  PRINT  CHR$ (15)
4Ø5Ø  FOR I = I TO W%(Ø,Ø)
4Ø6Ø  PRINT I,W$(I),"";
4Ø7Ø  FOR J = 1 TO W%(I,Ø): PRINT AL$(W%(I,J));"/";: NEXT : PRINT
4Ø8Ø  NEXT
4Ø9Ø  PRINT D$;"PR#Ø"
41ØØ  RETURN
5ØØØ  REM  ENTER MESSAGES
5ØØ3  HOME : PRINT  TAB( 1Ø)"ENTER NEW MESSAGES"
5ØØ5 M = M%(Ø,Ø) + 1: IF M > 1ØØ THEN  POP : POP : RETURN
5Ø1Ø  HOME : GOSUB 8ØØ
5Ø2Ø M%(Ø,Ø) = M
5Ø3Ø  INPUT "ENTER ANOTHER MESSAGE ";A$: IF A$ = "N" THEN  RETURN
5Ø4Ø  GOTO 5ØØ5
6ØØØ  REM  VIEW A MESSAGE
6Ø1Ø  HOME : PRINT  TAB( 1Ø)"VIEW A MESSAGE"
6Ø2Ø  INPUT "ENTER MESSAGE NO.: ";A$: IF A$ = "" THEN 6Ø2Ø
6Ø3Ø M =  VAL (A$): IF M < 1 OR M > M%(Ø,Ø) THEN 6Ø2Ø
6Ø4Ø  PRINT : PRINT "MESSAGE NO. ";M
6Ø5Ø  FOR I = 1 TO M%(M,Ø): PRINT W$(M%(M,I));" ";: NEXT : PRINT "."
6Ø6Ø  PRINT : INPUT "IS THIS MESSAGE CORRECT? ";A$: IF A$ = "N" THEN  GOSUB
     8ØØ
6Ø7Ø  PRINT : INPUT "VIEW ANOTHER MESSAGE ";A$: IF A$ <  > "N" THEN 6Ø2Ø
6Ø8Ø  RETURN
65ØØ  REM  DELETE A MESSAGE
651Ø  HOME : PRINT  TAB( 1Ø)"DELETE A MESSAGE"
652Ø  INPUT "ENTER MESSAGE NO. TO DELETE: ";A$: IF A$ = "" THEN 652Ø
653Ø M =  VAL (A$): IF M < 1 OR M > M%(Ø,Ø) THEN 652Ø
654Ø  PRINT : PRINT "MESSAGE NO. ";M
655Ø  FOR I = 1 TO M%(M,Ø): PRINT W$(M%(M,I));" ";: NEXT : PRINT "."
656Ø  PRINT : INPUT "DELETE THIS MESSAGE? ";A$: IF A$ <  > "Y" THEN 658Ø
657Ø  FOR I = Ø TO M%(M%(Ø,Ø),Ø):M%(M,I) = M%(M%(Ø,Ø),I): NEXT :M%(Ø,Ø) =
     M%(Ø,Ø) - 1
658Ø  PRINT : INPUT "DELETE ANOTHER MESSAGE?";A$: IF A$ = "Y" THEN 65ØØ
659Ø  RETURN
7ØØØ  REM  PRINT MESSAGE TEXT
7Ø1Ø  PRINT D$;"PR#1"
7Ø2Ø  PRINT  CHR$ (9);"135N"
7Ø3Ø  PRINT  CHR$ (14)"MESSAGE TEXT FOR FILE ";MF$
7Ø4Ø  PRINT  CHR$ (15)
7Ø5Ø  FOR I = 1 TO M%(Ø,Ø)
7Ø6Ø  PRINT I,"";
7Ø7Ø  FOR J = 1 TO M%(I,Ø): PRINT W$(M%(I,J));" ";: NEXT : PRINT "."
7Ø8Ø  NEXT
7Ø9Ø  PRINT D$;"PR#Ø"
71ØØ  RETURN
8ØØØ  REM  SPEAK THE MESSAGES
8Ø1Ø  HOME : PRINT  TAB( 5)"SPEAK MESSAGES"
8Ø2Ø  PRINT "PRESS RETURN FOR MENU"
8Ø3Ø  VTAB 5: HTAB 1Ø: INPUT "ENTER MESSAGE NUMBER: ";A$: IF A$ = "" THEN
      RETURN
8Ø4Ø A =  VAL (A$): IF A < 1 OR A > M%(Ø,Ø) THEN 8Ø1Ø
8Ø5Ø  GOSUB 821Ø
8Ø6Ø  GOTO 8Ø3Ø
82ØØ  REM  SPEAK MESSAGE A
821Ø  FOR W = 1 TO M%(A,Ø): REM  WORDS IN MESSAGE
822Ø I = M%(A,W): REM  WORD CODE
823Ø  GOSUB 831Ø
824Ø  NEXT W
825Ø  RETURN
83ØØ  REM  SPEAK WORD I
831Ø K = W%(I,Ø): REM  #OF ALLOPHONES IN WORD
832Ø  FOR J = Ø TO K: POKE 832 + J,W%(I,J): NEXT
833Ø  VTAB 1Ø: HTAB 5: PRINT "                              ": VTAB 1Ø: HTAB 5: PRINT
     W$(I)
834Ø  CALL 768
835Ø  RETURN
1ØØØØ  REM  INIT FILES
1ØØ1Ø D$ =  CHR$ (4): PRINT D$;"MONC,I,O"
1ØØ2Ø  INPUT "ENTER DICTIONARY FILENAME";A$
1ØØ25  IF A$ = "" THEN A$ = "WORDS"
1ØØ3Ø DF$ = A$ + ".COD"
1ØØ6Ø  PRINT D$;"OPEN";DF$
1ØØ7Ø  PRINT D$;"WRITE"DF$
1ØØ8Ø  PRINT Ø
1ØØ9Ø  PRINT D$;"CLOSE"
1ØØ93  INPUT "ENTER MESSAGE FILE NAME: ";A$
1ØØ95  IF A$ = "" THEN A$ = "MESSAGES"
1ØØ97 MF$ = A$ + ".COD"
1Ø1ØØ  PRINT D$;"OPEN";MF$: PRINT D$;"WRITE ";MF$: PRINT Ø: PRINT D$;"CLOS
     E"
1Ø1Ø5  PRINT D$;"NOMONC,I,O"
1Ø11Ø  GOTO 5
```

Listing 2. Editor program.

rithm, and it will then generate the proper codes to be spoken. The program necessary to achieve this end, however, is very complicated and requires a rule table containing around 300–600 rules to handle all the contextual arrangements letters have in the various words in the language.

The program I have included in this article is based on the first method, the dictionary method. The reason I did this, in spite of its limitations, is because its simplicity allowed me to generate a small dictionary of words to experiment with until I could come up with a text-to-speech algorithm. When I get it going I will write a second article on that and share it with you.

The program shown in Listing 2 is the program I call the Editor. This program uses 3 text files which are stored on disk and read into memory when required to generate speech. One file contains the allophone codes for all the words in the dictionary. The second contains the text of the words in the dictionary, and the third is a file of messages made up from the words in the dictionary. By giving different file names to the files, one can generate several dictionaries and several message files to give an unlimited vocabulary to the machine. The only drawback is that only 200 words with 32 allophones each, and 100 messages with 16 words each, can be stored in memory at a time and still leave enough memory for

1	0	ZZ/YR/OW/	66	DISCONNECTED	DD2/IH/SS/PA3/KK1/AX/NN1/EH/PA2/KK1/PA3/TT2/IH/PA1/DD1/
2	1	WW/AX/AX/NN1/	67	STATUS	SS/SS/PA3/TT2/AE/PA3/TT2/AX/SS/
3	2	TT2/UW2/	68	LOGGED	LL/AO/PA2/GG3/PA2/DD1/
4	3	TH/RR1/IY/	69	MEMORY	MM/EH/MM/OR/RR2/IY/
5	4	FF/FF/OR/	70	DIAL	DD2/AY/LL/
6	5	FF/FF/AY/VV/	71	PLEASE	PP/LL/IY/ZZ/
7	6	SS/SS/IH/IH/PA3/KK2/SS/	72	ENTER	EH/NN1/PA3/TT2/ER1/
8	7	SS/EH/EH/VV/IH/NN1/	73	CODE	KK3/OW/DD1/
9	8	EY/PA3/TT2/	74	NUMBER	NN1/AX/MM/PA2/BB1/ER1/
10	9	NN1/AA/AY/NN1/	75	FREQUENCY	FF/FF/RR2/IY/PA3/KK3/WW/EH/NN1/SS/IY/
11	TEN	TT2/EH/EH/NN1/	76	ALERT	AX/LL/ER1/PA3/TT2/
12	ELEVEN	IH/LL/EH/EH/VV/IH/NN1/	77	KILO	KK1/IH/LL/OW/
13	TWELVE	TT2/WH/EH/EH/LL/VV/	78	PA1	PA1/
14	THIRTEEN	TH/ER1/PA2/PA3/TT2/IY/NN1/	79	PA2	PA2/
15	FOURTEEN	FF/OR/PA2/PA3/TT2/IY/NN1/	80	PA3	PA3/
16	FIFTEEN	IH/FF/PA2/PA3/TT2/IY/NN1/	81	PA4	PA4/
17	SIXTEEN	SS/SS/IH/PA3/KK2/SS/PA2/PA3/TT2/IY/NN1/	82	PA5	PA5/
18	SEVENTEEN	SS/SS/EH/VV/TH/NN1/PA2/PA3/TT2/IY/NN1/	83	MEGA	MM/EH/GG2/AX/
19	EIGHTEEN	EY/PA2/PA3/TT2/IY/NN1/	84	RESET	RR1/IY/SS/EH/PA3/TT2/
20	NINETEEN	NN1/AY/NN1/PA2/PA3/TT2/IY/NN1/	85	OF	AX/VV/
21	TWENTY	TT2/WH/EH/EH/NN1/PA2/PA3/TT2/IY/	86	BAND	BB2/AE/AE/NN1/PA2/DD1/
22	THIRTY	TH/ER2/PA2/PA3/TT2/IY/	87	METER	MM/IY/TT2/ER1/
23	FORTY	FF/OR/PA3/TT2/IY/	88	AND	AE/NN1/PA2/DD1/
24	FIFTY	FF/FF/IH/FF/FF/PA2/PA3/TT2/IY/	89	FORWARD	FF/FF/OR/WW/ER1/PA1/DD1/
25	SIXTY	SS/SS/IH/PA3/KK2/SS/PA2/PA3/TT2/IY/	90	ANTENNA	AE/NN1/PA3/TT2/EH/EH/NN1/AX/
26	SEVENTY	SS/EH/VV/IH/NN1/TT2/IY/	91	SYNTHESIZER	SS/SS/IH/NN1/TH/AX/SS/AY/ZZ/ER1/
27	EIGHTY	EY/PA3/TT2/IY/	92	TRANSMITTER	TT2/RR2/AE/AE/NN1/ZZ/PA3/MM/IH/PA3/TT2/ER1/
28	NINETY	NN1/AY/NN1/PA3/TT2/IY/	93	VOX	VV/AA/PA3/KK1/SS/
29	HUNDRED	HH2/AX/AX/NN1/PA2/DD2/RR2/IH/IH/PA1/DD1/	94	COMPUTER	KK1/AX/MM/PP/YY1/UW1/TT2/ER1/
30	THOUSAND	TH/AA/AW/ZZ/TH/PA1/PA1/NN1/DD1/	95	CONTROL	KK1/AX/NN1/PA3/TT2/RR2/OW/LL/
31	MILLION	MM/IH/IH/LL/YY1/AX/NN1/	96	PHONE	FF/FF/OW/NN1/
32	A	EY/	97	RECEIVER	RR1/IY/SS/IY/VV/ER1/
33	B	BB2/IY/	98	STATION	SS/SS/TT2/EY/SH/AX/NN1/
34	C	SS/SS/IY/	99	SORRY	SS/SS/AO/PA1/RR1/IY/
35	D	DD2/IY/	100	THANK	TH/AE/NG/PA2/KK2/
36	E	IY/	101	INVALID	IH/NN1/PA2/VV/AE/AE/LL/IH/PA1/DD1/
37	F	EH/EH/FF/FF/	102	ACCESS	AE/AE/PA3/KK2/SS/EH/SS/
38	G	JH/IY/	103	CHANGE	CH/EY/NN1/JH/
39	H	EY/PA2/PA3/CH/	104	HERTZ	HH1/ER1/TT1/SS/
40	I	AA/AY/	105	FROM	FF/FF/RR2/AX/MM/
41	J	JH/EH/EY/	106	IS	IH/ZZ/
42	K	KK1/EH/EY/	107	WAS	WW/AX/ZZ/
43	L	EH/EH/EL/	108	CAN	KK1/AE/NN1/
44	M	EH/EH/MM/	109	GIGA	GG1/IH/GG2/AX/
45	N	EH/EH/NN1/	110	THE	DH1/AX/
46	O	OW/	111	AN	AE/NN1/
47	P	PP/IY/	112	AM	AE/MM/
48	Q	KK1/YY1/UW2/	113	WERE	WW/ER1/
49	R	AR/	114	WILL	WW/IH/LL/
50	S	EH/EH/SS/SS/	115	REMOTE	RR1/IY/MM/OW/PA3/TT2/
51	T	TT2/IY/	116	THEY	DH1/EY/
52	U	YY1/UW2/	117	THEM	DH1/EH/MM/
53	V	VV/IY/	118	HELLO	NH1/EH/LL/OW/
54	W	DD2/AX/PA1/BB1/EH/LL/YY1/UW1/	119	TEMPERATURE	TT2/EH/MM/PA3/PP/RR2/AX/PA3/CH/ER1/
55	X	EH/EH/PA3/KK2/SS/SS/	120	CORRECT	KK3/OR/EH/KK3/TT2/
56	Y	WW/AY/	121	INCORRECT	IH/NN1/PA3/KK3/OR/EH/PA3/KK3/TT2/
57	Z	ZZ/IY/	122	CANNOT	KK1/AE/NN1/AA/PA1/TT2/
58	TIME	TT2/AY/MM/	123	RECOGNIZE	RR1/EH/PA3/KK1/AX/PA1/GG3/NN1/AY/ZZ/
59	DATE	DD2/EY/PA2/TT2/	124	HAS	HH1/AE/ZZ/
60	SYSTEM	SS/SS/IH/SS/TT2/AX/MM/	125	BEEN	BB2/EH/NN1/
61	NOW	NN2/AW/	126	UNDER	AX/NN1/PA3/DD2/ER1/
62	PATCH	PP/AE/PA3/CH/	127	OVER	OW/VV/ER1/
63	ON	AA/AA/NN1/	128	HOOK	HH2/UH/UH/KK2/
64	OFF	AO/AO/FF/FF/	129	HAVE	HH1/AE/VV/
65	CONNECTED	KK1/AX/NN1/EH/PA2/KK1/PA3/TT2/IH/DD1/	130	DO	DD2/UW2/

Fig. 7. Sample words for ham-oriented applications.

an application program. This, in spite of its limitation, seems to be versatile enough for most experimental applications.

The routines shown in Listing 3 are the routines which would be added to another Basic program to allow it to use the dictionaries and message files created using the Editor program.

Using the Editor Program

The first thing that needs to be done when dictionary and message files are created is to initialize them. This is done by typing "RUN 10000" from the Basic prompt (]). The program will ask you for the dictionary file name you wish to create. Enter this name. If you do not enter anything except the Return key, the default file name will be WORDS. The new file will be initialized and then will ask you for the file name of the message file you wish to create. The default file name is MESSAGES.

Once the files are created, the program restarts automatically. The program asks for the file names of the dictionary and message files you wish to use. Enter these and wait for the files to be loaded. The bigger the dictionary, the longer it takes to load.

The main menu then appears. Select the desired option. *Please remember:* Do not exit the program after an editing session without using the QUIT option. Otherwise, you will lose all the changes and entries you have made for that session. The QUIT option writes the files back out to the disk.

Enter New Words: This option allows you to enter the text and the allophone codes for the words and store them in the dictionary. The first thing to be done is to enter the text of the word. Then, after you verify that the word is as you wish it to be, the program will check to see if it is already in the dictionary. If it is, you will see the prompt, WORD ALREADY IN DICT., and the word text will be re-requested. If it is not, you will then be able to enter, one at a time, the individual allophones needed for the word. When all of the allophones have been entered, just press Return. The program will request the text for the next word. If all of the words desired have been entered, just press Return at this point and the program will return to the menu. For example, to enter the word HELLO into the dictionary, you would type H E L L O Return for the text entry. The program will prompt HELLO CORRECT? If so, press Return. If not, enter N and Return and reenter the word. If correct, the program will begin asking for the allophones. To do this you would enter HH1 and Return. The program would then verify the allophone to make sure it was a valid one. If it wasn't, it would prompt INVALID ALLOPHONE... REENTER and re-request it. If it was correct, it would request the next. You would then enter the next one, EH. Then LL, AX, and OW. For the last entry (since there are no more allophones to be entered) you would just press the Return key. You would then get the prompt for the text for the next word. This process can continue until 200 words have been entered or you press Return in response to the word text entry.

Remember when creating your dictionary to take advantage of words/letters/numbers which sound the same. For example, if you enter "for," you can then use it in place of 4, four, fore, etc. Fig. 7 contains some sample words which I have come up with for general ham-oriented applications.

View/Change A Word: This option allows you to call up a word in the dictionary and view or change the allophone associated with it. If the word is not in the dictionary you will see a prompt, WORD NOT IN DICT. Remember, the word must be spelled exactly as it was first entered, including spaces. Once the word is found, the program displays the word and its associated allophones. If they are not correct, you can reenter them in the same manner you initially did. If they are, you can view another word or return to the menu by answering the prompts accordingly.

Delete A Word: This option allows you to get rid of unwanted words from the dictionary. Simply type in the word you wish to delete from the dictionary. The routine will check to see if it is in the dictionary, and if it

```
131    NOT           NN2/AA/TT2/
132    THAT          DH1/AE/TT2/
133    BUT           BB2/AX/TT2/
134    AT            AE/TT2/
135    POINT         PP/OY/NN1/TT2/
136    THIS          TH/IH/SS/
137    EMERGENCY     IY/MM/ER1/PA2/JH/EH/NN1/SS/IY/
138    SHUTDOWN      SH/AX/TT2/PA4/DD1/AW/NN1/
139    LOG           LL/AO/PA2/GG3/
140    DIRECT        DD2/AY/PA2/RR1/EH/PA2/KK2/PA2/TT2/
141    REDIAL        RR1/IY/PA1/DD2/AY/AX/LL/
142    ANSWER        AE/AE/NN1/SS/ER1/
143    MODE          MM/OW/PA2/DD1/
144    AUDIO         AO/AO/PA1/DD1/IY/OW/
145    IN            IH/NN1/
146    RADIO         RR1/EY/DD2/IY/OW/
147    NET           NN1/EH/TT2/
148    MODULATION    MM/AA/DD1/JH/YY1/UW1/LL/EY/SH/AX/NN1/
149    UPPER         AX/PP/ER1/
150    LOWER         LL/OW/ER1/
151    SIDEBAND      SS/AY/DD1/PA1/BB2/AE/NN1/DD1/
152    PROCESSOR     PP/RR2/AA/SS/EH/SS/ER1/
153    BATTERY       BB2/AE/TT2/ER1/IY/
154    MIC           MM/AY/KK2/
155    SPEAKER       SS/PP/IY/KK1/ER1/
156    CONTEST       KK1/AA/NN1/PA2/TT2/EH/SS/TT2/
157    WAVE          WW/EY/VV/
158    TRANSMIT      TT2/RR2/AE/NN2/ZZ/MM/IH/TT2/
159    RECEIVE       RR1/IY/SS/IY/VV/
160    DEGREES       DD2/AX/GG2/RR2/IY/ZZ/
161    REPEATER      RR1/IY/PP/IY/TT2/ER1/
162    SINGLE        SS/IH/NG/GG3/EL/
163    QUARTER       KK3/WW/OR/TT2/ER1/
164    HALF          HH1/AE/FF/
165    LINEAR        LL/IH/NN1/IY/ER2/
166    PHASE         FF/EY/ZZ/
167    PRE           PP/RR2/IY/
168    WATT          WW/AA/TT2/
169    WATTS         WW/AA/TT1/SS/
170    ALPHA         AE/LL/FF/AX/
171    BRAVO         BB1/RR2/AA/VV/OW/
172    CHARLIE       CH/AR/LL/IY/
173    DELTA         DD2/IH/EH/LL/PA3/TT2/AX/
174    ECHO          EH/PA3/KK3/OW/
175    FOXTROT       FF/AA/KK2/SS/PA3/TT2/RR2/AA/PA3/TT2/
176    GOLF          GG2/AA/AX/LL/FF/
177    HOTEL         HH2/OW/PA3/TT2/EH/LL/
178    INDIA         IH/NN1/PA3/DD2/IY/AX/
179    JULIET        JH/UW2/LL/IY/EH/PA3/TT2/
180    LIMA          LL/IY/MM/AX/
181    NOVEMBER      NN2/OW/VV/EH/MM/PA2/BB2/ER1/
182    OSCAR         AA/SS/PA3/KK1/ER1/
183    PAPA          PP/AA/PP/AX/
184    QUEBEC        KK1/YY1/UW1/IY/PA2/BB2/EH/PA3/KK2/
185    ROMEO         RR1/OW/MM/IY/OW/
186    SIERRA        SS/IY/EH/PA1/RR1/AX/
187    TANGO         TT2/EY/NG/PA2/GG2/OW/
188    UNIFORM       YY1/UW1/NN1/IH/FF/OR/MM/
189    VICTOR        VV/IH/PA3/KK2/PA3/TT2/OW/OR/
190    WHISKEY       WH/IH/SS/PA3/KK1/IY/
191    XRAY          EH/KK2/SS/PA3/RR1/EY/
192    YANKEE        YY2/EY/NG/PA3/KK1/IY/
193    ZULU          ZZ/UW2/LL/UW2/
194    CARRIER       KK1/XR/IY/ER1/
195    AMPLITUDE     AE/MM/PA3/PP/LL/IH/PA3/TT2/UW2/PA3/DD1/
```

```
1 D$ =  CHR$ (4)
2  DIM M%(100,64): REM   MESSAGE ARRAY:100 MESSAGES W/64 WORDS EACH
4  DIM W%(200,32)
6  REM  OPEN FILES
8  HOME
10  VTAB 5: INPUT "ENTER DICTIONARY NAME: ";A$: IF A$ = "" THEN A$ = "WORD
     S"
12 DF$ = A$ + ".COD"
14  VTAB 7: INPUT "ENTER MESSAGE FILE NAME: ";A$: IF A$ = "" THEN A$ = "ME
     SSAGES"
16 MF$ = A$ + ".COD": GOSUB 20: GOSUB 40
18  GOTO 1000
20  REM  READ DICTIONARY FILE
22  PRINT D$;"OPEN ";DF$
24  PRINT D$;"READ ";DF$
26  INPUT W%(0,0):J = W%(0,0)
28  IF J = 0 THEN 36
30  FOR I = 1 TO J: INPUT W%(I,0):L = W%(I,0): REM  INPUT A WORD. J IS # O
     F WORDS
32  FOR K = 1 TO L: INPUT W%(I,K): NEXT : REM  INPUT ALLOPHONE CODES. L IS
      # OF CODES
34  NEXT I
36  PRINT D$;"CLOSE"
38  RETURN
40  REM  READ MESSAGE FILE (MF$ IS FILE NAME)
42  PRINT D$;"OPEN ";MF$
44  PRINT D$;"READ ";MF$
46  INPUT M%(0,0):L = M%(0,0): REM   INPUT # OF MESSAGES
48  IF L = 0 THEN 56
50  FOR I = 1 TO L: INPUT M%(I,0):M = M%(I,0): REM  INPUT MESSAGE. M=# OF
     WORDS IN MESSAGE
52  FOR J = 1 TO M: INPUT M%(I,J): NEXT : REM   INPUT WORD CODES
54  NEXT
56  PRINT D$;"CLOSE"
58  RETURN
1000  REM  TEST
1010  FOR MSG = 1 TO 10: GOSUB 60000: NEXT
1020  FOR WD = 1 TO 100: GOSUB 61000: NEXT
1030  END
60000  FOR X9 = 1 TO M%(MSG,0):WD = M%(MSG,X9): GOSUB 61000: NEXT : RETURN
      : REM  SPEAK MESSAGE MSG
61000  FOR AL = 0 TO W%(WD,0): POKE 832 + AL,W%(WD,AL): NEXT : CALL 768: RETURN
      : REM  SPEAK WORD WD
```

Listing 3. Application routines.

is, it will display the text and allophone data for that word. If after verification you wish to delete the word, just press Y in response to the prompt. The next prompt asks you if you wish to delete another word. If so, enter Y. Any other response will return the program to the menu.

Print Dictionary: This option simply sends the entire dictionary to a printer. It will print the file name of the dictionary at the top of the page, the number associated with each word, the word text, and the allophones associated with it. The routine uses the CHR$ (15) code in line 4040 to put my Epson MX-80 printer in the condensed-print mode to allow the printing of 132 columns on one line. You might wish to change that code if you have different printer.

Create Messages: This option allows you to create messages using the words in the dictionary which are currently in memory. Once you create a message file, you must make sure you use the same dictionary with that file in order to make sure the proper words will be spoken.

Messages are created by entering the words desired in the message one at a time. When all the words have been entered, just press Return. You will be asked if you wish to enter another message. If so, just press Return. If not, enter N and Return. With each word entered, the routine will check to see if the word is in the dictionary. If not, it will prompt WORD NOT IN DICT. and request another word. Remember, the message is referred to by its message number. This number is shown at the top of the screen when entering the message. This number can also be obtained by using the Print Message Text option described later.

View/Change Messages: This option functions just like the View/Change Words option, only you can call up the message by the message number associated with it and see what words make it up. If a message is not correct, you can reenter the words as done above.

Delete Messages: This option allows you to delete an unwanted message. Enter the message number of the message you wish to delete. The routine will display the message text on the screen for verification. If it is OK to delete, type Y to the delete prompt. If you wish to delete another message, answer Y to the next prompt. Anything else will cause the program to return to the menu.

Print Message Text: This option will print all of the messages currently in memory. The message number and the associated words are listed.

Speak Messages: This is the most enjoyable option. When a message number is entered, each of the words in the message is printed on the screen and simultaneously spoken. This way you can verify the message and the pronunciation of the word and then go back and change anything if necessary.

Using the Application Routines

The application routines shown in Listing 3 allow you to use previously generated dictionaries and messages in other programs simply by calling the words or messages up with their access code numbers. To use the routines, the low numbered lines shown in Listing 3 (those below 100) would be merged into the program you wish to speak at the beginning of the program, before line 100. The high numbered lines would be merged after the last of the normal program lines. Then, when the program is run the dictionary and message arrays are dimentioned, file names for the dictionary and message files are entered, the data is read into memory, and the program is then ready to speak the messages and words.

This is done by setting MSG equal to the message number of the message you wish to have spoken, and then doing a GOSUB 60000. To speak an individual word in the dictionary, set WD equal to the word to be spoken and do a GOSUB 61000. Make sure MSG and WD are not greater than the maximum number of messages or words in memory.

You must also make sure that the variables used in these routines are not used in the target program in order to avoid any conflicts. Of course, these variable names and line numbers can be changed to suit the application. The important things to remember are to make sure that the proper dictionary and message arrays are dimensioned, the proper file names are entered or generated, and that the data is loaded into memory prior to calling subroutines 60000 or 61000. If it is not desirable to enter the file names from the keyboard every time the program is run, then you might wish to define them in a program line prior to reading the files.

This project has by far been the most gratifying project I have ever undertaken on the computer. It didn't cost much, it went together easily, the programming was simple, and it worked without much fiddling. I was able to take this project from a bag of parts to the finished article in 3 days. The excitement of hearing your computer talk to you will keep you busy at the keyboard for hours.

The applications of such a device are unlimited. Whether it be for assisting the handicapped, entertaining and educating the kids, or adding a unique embellishment to the ham shack, it will definitely be a worthwhile investment. Your imagination is the only limit on its possibilities. If you do not like to type in long program listings, I will be glad to send you a copy of the programs shown in this article on a DOS 3.3 disk for $20.00 postage paid.

In the meantime I will be working on a text-to-speech algorithm for this synthesizer. If you are interested in this or have any comments on this article or this fascinating technology, drop me a card or a letter, I would love to hear from you. Keep talkin'! ■

Ed Ingber WA6AXX
Advanced Computer Controls, Inc.
10816 Northridge Square
Cupertino CA 95014

Takin' It to the Streets—Part II

Last month's discussion was only half of the story—now discover what remote control can do when the ShackMaster's power is unleashed!

In Part I, I described the benefits of crossband linking and telephone access to your home station. The ShackMaster™ station controller connects to your HF transceiver, one or two VHF/UHF transceivers, and other station equipment. Now I'll describe some other features of the station controller that can make amateur radio more fun and useful in your everyday life.

Electronic Mailbox

Hams have handled traffic since the beginning of amateur radio. Organized traffic handling was the original basis for the formation of the American Radio Relay League. Hams relay messages from one non-ham to another non-ham and from hams to non-hams. These messages are called third-party traffic. MSOs and repeater mailboxes are examples of modern technology applied to handling traffic between hams.

Having a station at home makes it possible to relay third-party messages between you and your family conveniently. Why would you want to relay traffic to your wife and kids? Perhaps because you'll be home late from work. Or you want to let them know that everything is OK. They might want you to call to see if you need to do an errand on your way home. And since you both might not be available at the same time, it would be nice to be able to leave a message.

An electronic mailbox designed for use by the family should be easy and fun to use. Ten canned messages that cover many typical situations are available in ShackMaster. The messages may be left by the ham while away using touchtone™ commands over the air, and incoming messages may be retrieved by the family member by pressing the Read button. The mailbox message is spoken in synthesized speech to the family member. Outgoing messages to the ham can be loaded by pressing the Load button. The speech synthesizer acknowledges entry of the message.

Front-panel lights indicate the presence of incoming or outgoing mail. Mail can also be loaded and retrieved by the non-ham by calling home on the telephone.

Remotely-Controlled Intercom

Third parties are permitted to participate in amateur communications provided that a control operator is present at the control point of the station. This provision is the basis for allowing a friend to talk over your radio, and is also the basis for all phone-patch and autopatch operation.

Virtually all hams have used, or at least have heard, a repeater autopatch. You've probably used your repeater's autopatch to call home or to call the police or report a traffic accident. The patch allows amateurs, through interconnection of the repeater to the phone line, to talk with non-hams. This is a form of third-party traffic known as participation-through-phone-line interconnection. A control operator is in control (typically remote control) of the repeater during the patch.

Now imagine that instead of the phone line connected to the repeater there was a wire to a speaker and microphone at the location of the person you wanted to talk with. Now replace the repeater with your home station. You already have a speaker and microphone in your shack; add a controller to provide you, the control operator, with complete remote control of your home station—and you have ShackPatch! It's an autopatch to home without using the phone!

To activate ShackPatch, enter a touchtone command as you would to bring up a repeater autopatch. ShackPatch generates an electronic ring at home, similar to a telephone. Anyone at home can answer it just by pressing the Answer button. From there, the "patch" proceeds as an exchange of transmissions synchronized by PTT. Our friend, the control window (see Part I), keeps you in complete remote control of your home station with the ability to terminate the patch within a couple of seconds if necessary. Your response time in controlling your home station is identical to the case where you would be standing over the shoulder of a third party who was using your station.

Why have a ShackPatch if there's already a repeater au-

topatch available? Perhaps you don't, in fact, belong to a club or repeater group with autopatch facilities. Or if you do, chances are that when you want to use the patch, such as on the way home from work, typically the repeater is busy. Maybe calling home is a long-distance call from the repeater. Or perhaps you just don't want hundreds of ears listening to you and your wife conversing.

A typical electronic mailbox/ShackPatch scenario could be as follows:

• The XYL is about to go out to pick up the kids after school. Frank Ham is still at work. Before she leaves, she loads the electronic mailbox with "I will be home late," and "Please call home."

• On Frank's way home, he checks in to pick up the mail, then tries to call home by bringing up ShackPatch. The XYL isn't back yet, so Frank leaves a message "All is OK." Later, he tries ShackPatch again, talks with the XYL, and learns that he needs to pick up his daughter Julie at her friend's house.

The mailbox and ShackPatch can be used on a simplex frequency or through a repeater for greater range. And the control transceiver can be commanded to QSY, so we can move ShackMaster off frequency to handle our traffic.

Simplex Autopatch

While ShackPatch allows us to talk with family members (third parties) by direct participation, sometimes it's useful to be able to place a "real" phone call. Perhaps a repeater autopatch isn't available. Since you've already got a control link between you and your home station, a simplex autopatch simply involves controlling an interconnection to your home phone line.

PersonalPatch™, the simplex patch in ShackMaster, allows you to place outgoing calls. As with crossband linking and ShackPatch, the control window keeps you in control of your home station, allowing you the opportunity to send commands as desired every few seconds.

The patch is VOX-activated from the phone, that is, your home control transceiver transmits only when the called party is talking. If he continues to talk for several seconds, the control window allows you to interrupt or exercise control.

A phone number can be stored in ShackMaster's autodial memory and easily dialed with a touchtone command. Any phone number can be dialed as well, with a selectable-toll-restrict capability. The phone number is regenerated into the phone line as either DTMF or dial pulse signaling.

Although PersonalPatch is a "simplex patch," it can be operated through any repeater for greater range.

BSR X10 Shack Control

With ShackMaster you can turn on and off station equipment using the interface to the BSR X10 home-control system. An infrequently practiced aspect of amateur radio is radio-control operation, defined as "one-way communication for remotely controlling objects or apparatus other than Amateur Radio stations." While not the most important aspect of amateur radio, it's specifically permitted in §97.89 (Points of Communication) (b): Amateur Radio stations may transmit one-way signals to receiving apparatus while in beacon operation or *radio control operation*.

When many hams think of radio remote control they think of radio-controlled model boats and planes. But if you can radio-control boats and planes, why not other things around the house? Turn on the lights before arriving home. Turn on the porch light if you're going to be late—or the air

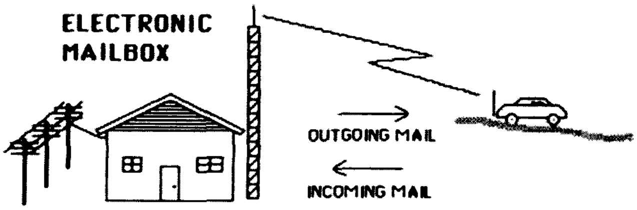


Fig. 1.

conditioner so that the house is cool by the time you get home.

The BSR system is based on a system controller which injects 100-kHz signaling directly into the power line to address lamp and appliance modules located throughout the house. The modules plug into wall outlets and then lamps and appliances plug into the modules. The modules contain relays or SCRs to control power to the appliances.

Up to sixteen independent unit codes are addressable with the BSR system. All of the lamps in one room could be addressed as one unit code, the HF rig as another, the air conditioner as another, etc. To avoid interference with neighbors who own a BSR system, an installation is assigned one of sixteen house codes (A–P).

The BSR system is usually controlled by BSR's command console. However, ShackMaster couples to the BSR system through the Heathkit® RS-232-to-BSR X10 interface. Serial data commands from ShackMaster, in response to your touchtone commands over the air, command the various pieces of equipment connected to BSR modules. ShackMaster acknowledges your commands with synthesized speech responses. The BSR system can also be controlled over the phone through ShackMaster.

A Family Affair

Amateur radio desperately needs to grow in order to justify the retention of its frequency allocations in the face of increasing competition for spectrum. The best prospects for new hams *should* be your own family members. No one else has the same level of exposure to the benefits of amateur radio or such proximity to a teacher, or "Elmer."

By their very nature, many ham-radio activities may exclude family members: club meetings, special events, and, most of all, operating. The impression may be that ham radio is something that takes up all of daddy's spare time. This often results in feeling of resentment toward amateur radio from the people who would otherwise be the best possible candidates for recruitment.

One of the intents of the third-party participation provisions in the rules is "to allow persons who are not

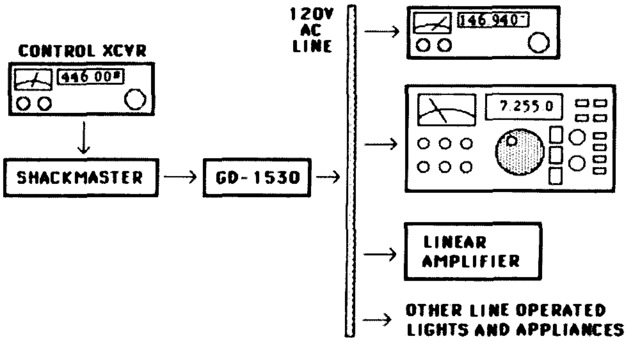


Fig. 2.

licensed Amateur Radio operators to experience the benefits of this service and to stimulate their interest in Amateur Radio" (Kowalski, FCC, 1984). Allowing a youngster to talk with his dad over ShackPatch while he's on his way to or from work gives the child an insight into the benefits of getting a license of his own. Instead of being limited to talking over the radio when his father is in remote control of the station, he *could* have a radio of his own and use it *anytime* to talk with *anyone!*

The electronic mailbox, ShackPatch, and BSR home control help create a positive impression of amateur radio and the services it offers in the minds of the amateur's family members. These features involve the family in amateur radio instead of isolating them from it.

Other Applications

ShackMaster's third-party traffic and participation features make it useful in applications other than with the home station. A transceiver and ShackMaster located at the Red Cross, weather bureau, or local hospital can provide many of the benefits of amateur radio for emergency and priority situations without the need for a ham to man the station locally.

Conclusion

Modern technology has worked its way into many aspects of amateur radio through feature-laden transceivers, computer-based communications, and highly sophisticated repeaters. The ShackMaster station controller takes a fresh approach in that it utilizes new technology to make your existing home station more valuable, both by making it available to you most of the time and by involving your family members—the best prospects to be new hams in amateur radio. ■

Victor J. Layton
PO Box 934
Northeast Harbor ME 04662

Above Intercept

It is cramped and dark and freezing cold, but the Allies need information. Has Britain's secret radio fallen into enemy hands?

It was like a return journey into the womb. The opening was so narrow that I could barely squeeze through. The new flight suit and the stiff webbing of the parachute harness made me feel as if I were a trussed turkey. The crew chief, a very helpful fellow who had braced himself firmly on the hardstand, was gleefully pushing on my rump.

Inside, the glow of my flashlight reflected from the exposed control cables, pushrods, and assorted valves reinforced my initial anatomic impression. In front of a tube-and-canvas seat there was a small steering wheel. Beyond it on a rough plywood shelf squatted "Joan-Eleanor." This was my first date with her, and I knew that we would become quite intimate during the long hours I would spend with her in this flying radio shack. You see, I was a spook for the World War II predecessor of the CIA, the OSS—the Office of Strategic Services.

The author in full flight gear by a British De Havilland Mosquito.

Let me put it on the line. Radios have always been magic to me, although they were essential to my trade. Information is a very perishable piece of goods unless it gets where it is supposed to go in a hurry, and there is nothing that can beat a radio to do that. In the old days we depended on CW and ciphers to get through. This was tedious, and every clandestine operator fully expected the other side to be tuned in to his frequency or to home in on the location of his transmitter—if they did not jam him as soon as he got on the air. This made the profession rather exciting and sometimes short-lived.

Back in the latter part of 1944, Joan-Eleanor, as this brand-new UHF set was called, had been developed to cure the problem. Two units made up the system. The ground unit was very small, no bigger than a little cigar box. Simple controls were mounted on the top and a puny dipole antenna could be attached in front. The radio was so compact that it could be hidden under a coat. Power was supplied by six miniature wet-cell batteries which could be clamped to the operator's waistline. The set was pre-tuned to a single UHF voice frequency. It was a revolutionary improvement over the sets we carried around in battered suitcases.

The airborne unit was larger, quite elaborate, and more powerful because it used the aircraft's electrical system. This radio was tunable and had conventional dials and controls. The mike input was compatible with the lip or throat microphone used by the plane's crew. In this instance, a hookup was provided to record all communications on an early recorder—one which used a thin magnetized steel wire. The recorder was mounted next to the radio. The antenna, consisting of several elements, was directional and was attached to a long steel tube which extended below the fuselage. It was retractable during takeoff and landing. The small steering wheel at the upper end served to turn the antenna in flight and to orient it for the best reception.

In addition to the electronics, the radio operator had in front of him a full display of basic flight instru-

ments, a magnetic compass, connections for his oxygen mask, and an outlet for his heated flying suit. The whole thing had been jerry-rigged in what normally was an inspection compartment in the forward part of the tail just behind the bomb bay, which now was packed with range-extension tanks.

The idea behind the equipment rested upon a peculiar propagation characteristic of UHF in which the signal reflection of the ground forms an inverted cone within which two-way communications are possible. The role of the airborne station was to locate and fly in this propagation cone at the highest possible altitude (where the orbit could be largest). The rotating antenna could be adjusted for the best signal, indicating where the propagation cone was located in space. This directional information was then passed to the flight crew in the cockpit so that they could keep the plane on station.

The aircraft selected for these airborne intelligence gathering missions was a De Havilland Mosquito, a machine built largely of wood and powered by two supercharged Rolls-Royce Merlin engines. With 1290 horsepower on each side, this was a high-performance plane capable of speeds up to 400 mph and a then-extraordinary service ceiling of 37,000 feet. It could fly well above the reach of German antiaircraft batteries, higher than their best fighters, and well beyond their top speed.

During periods of traffic between the ground and the aircraft there was practically no chance that the location of the transmitter could be DFed, and while it was conceivable that the signal from the aircraft could be picked up by a listening station on the same frequency, there was not much that the enemy could do about it. We were outside his capability to knock us out. All traffic was recorded on wire and the spools were sent by special courier to headquarters right after a mission for analysis and target designation.

It was during the latter part of November, 1944, when I was given orders to fly these missions as an operator. I had been picked because I spoke the languages of our agents behind the lines, local nationals who had volunteered to do some work for us in their occupied countries. There was another reason. I had been liberated by the Allies in northern France and knew the dangers, pressures, and gnawing fears which always come with the job.

The fact that I had had a complete flight physical and spent a claustrophobic hour in a decompression chamber to see if I was qualified for flight duty did not impress the US Navy Commander in charge of the Joan-Eleanor project or his staff of electronic wizards who made up the special unit at the Watton airbase, a field used by the 25th Bomber Group and a squadron of Mosquitoes. The latter were used to fly weather-reconnaissance and pathfinder missions. Three of their ships had been assigned to the Joan-Eleanor team and were modified to take the equipment, the range-extension tanks, and nuts like me. After a welcome briefing I was introduced to the head pilot, an Air Corps flyer with lots of experience in Mosquitoes. He seemed amused when I told him that I had been up in planes only a few times (usually as either a passenger or a parachutist), so he suggested that we take a look at the bird.

The Mark XVI Mosquito had fine lines in its mottled camouflage paint, but looked ungainly on the ground because of its three-point landing system. Following the pilot into the cockpit through a hatch behind the nose, I settled into the right seat and straddled the dual controls. The dash in front of me was cluttered with all kinds of instruments and there were black-box navigation aids on my side of the cockpit which I had never seen before. From the shoulders up, visibility was excellent through the Plexiglas™ canopy. The pilot explained that most of the armor and all the weapons had been removed to lighten the plane for the sake of altitude, speed, and range.

It was, in fact, a hot machine, with but one very bad habit. During hard landings it was commonplace for the fuselage tail section to break off behind the bomb bay and turn into a pile of assorted chips, toothpicks, and skewers (because it was made of wood). This was the place where I would be sitting.

On this sour note, we strolled under the starboard wing with its huge engine nacelle to look at the radio compartment. It was indeed very small, and I had to crawl on my hands and knees to get in. Once seated, I realized that everything was within reach and that probably one could survive in this broom closet for the six to eight hours which was the length of the average mission.

Clamped under the seat was a plastic funnel attached to a flexible hose which was described as a relief tube—a one-shot affair since it never failed to freeze up at high altitude. Then came the clincher. The access hatch could be jettisoned in an emergency, but the opening was too small to bail out with the parachute on. In theory, the radio operator was supposed to jump with the chest pack in his hand, hook it on while falling, and then pull the "D" handle. I was tempted to ask if any of my predecessors had ever survived such an escape procedure, but the bar at the club was about to open and my mouth had become so parched that I could not articulate the question. Besides, I had been told that I might get to meet Major Clark Gable, who was known to patronize the same establishment during these stressful times.

The first familiarization flight came the next day, and I sat in the navigator's seat. After takeoff we climbed steeply into the clouds and I watched the altimeter and rate of climb indicator wind up like crazy. It was an astonishing performance to an earthling like me, and I was elated when we broke out into brilliant sunshine looking down upon the cumuli and the haze of the English countryside. Climbing through 10,000 feet, the pilot instructed me to go on 100% oxygen. The plane leveled off at about 30,000 as the engine controls were set to the cruise mode. The indicated airspeed settled around 320 knots, and the outside air temperature showed a chilly −40° F.

The pilot made various maneuvers and I was allowed to touch the controls lightly to get the feel of the plane. It was a thrilling but short experience, especially since from here on out I would have to ride in the aft compartment and mess around with Joan-Eleanor.

After that it was just plain work, work, work. I was drilled on procedures, on techniques, and spent hours in my small radio shack. I learned to work the sets in my bulky flight gear, the heated suit, the gloves, the helmet, and how to use the oxygen. I did this by the red glow of the overhead light and also in total darkness to simulate power failure when it would have to be a matter of feel.

Ten days later, I flew my first simulated radio mission at altitude over the airfield. The sets had been warming

up during the climb and I was ready to click the transmit switch on at the precise time.

"George, George . . . this is Victor. Do you copy?"

There was no reply, and after several futile attempts I asked the pilot to shift his flight path so that I could give it another try. Finally, there was an audible response from base.

"Victor, Victor . . . this is George. You are loud and clear. How me?"

Hands flying, I pressed a button which would flick a light in the cockpit to show that there was contact with the ground and at the same time I hit the Record switch on the wire recorder. Directly in front of me the magnetic compass began to turn slowly, showing that we were flying in a shallow bank. Tentatively, I rotated the antenna steering wheel to search out the strongest signal. I chuckled at the idea that in a manner of speaking I was flying the aircraft, but there was work to do and the time had come to get my act together.

The fellow operating the ground set was reading off some prearranged poop, and I talked just enough to keep the contact going. After about ten minutes, George signed off and I signaled the cockpit that my work was done. During the descent to base I rewound my precious wire recording and pocketed the spool. It was going to be my graduation diploma. I felt pretty good about the whole mission until the pilot decided to perform some barrel rolls for my benefit, and I experienced such weightlessness and gut-wrenching Gs that I nearly lost everything in my stomach all over the radios, flight gear, and all other equipment.

Back on the hardstand the crew chief helped me crawl out through the hatch and gave us all a lift to the debriefing room. There we discussed the actual path of the aircraft over the base, and the technicians played the wire that I had brought back with me. It was a lousy recording, with static and fading, but it was audible and could be transcribed. Apparently, we had strayed outside of the propagation cone—or something had gone wrong with the equipment. The latter was hotly denied by the humorless naval type and his aides, but I did not mind taking the blame because I did not care if I ever flew in that contraption again and I knew that it would take a lot more practice and a healthy dose of luck to bring home the bacon.

It was mid-November when I was alerted for my first real mission over German-occupied territory. Our man, code named *Bobby*, had parachuted into Holland a few weeks ago and had made contact with the Dutch underground. Through the so-called innocent messages which were regularly broadcast by the BBC, a date and place had been set for a contact with Joan-Eleanor. This was to be two days later near the German-occupied town of Zwolle, east of the Zuider Zee.

Bobby was not a complete stranger to me, even though we had never met face to face. We had talked on the telephone while he was being kept in a safe house during his training because it was important for him to know to whom he would be talking while doing his stuff. He had spoken in English with the slight guttural accent so peculiar to Hollanders, and I felt pretty sure I could recognize it through distortion, fading, and static. After some pleading, I had been given a wax Dictaphone-cylinder recording of a conversation between *Bobby* and his case officer. A few playbacks gave me some confidence that I would recognize his voice.

Bobby and I also had agreed on a rather simple emergency code by which he could tell me that he was operating under duress—if this ever came to pass. He was to talk about the weather in the early stages of the contact, and this would be my cue. What would happen then was left to improvisation.

The preflight briefing was routine. Rendezvous over the target was scheduled for 1:30 in the morning, and we were to be at 35,000 feet for the orbit. Our plane was to go in with four other Mosquitoes on a pathfinder mission over the Ruhr, but somewhere over France we were to turn north, cross the battle line in southern Holland, and make for Zwolle. The return flight from the target after the contact would be unescorted over the North Sea.

The weather over the continent had been unusually bad for this time of the year, and the Air Corps had drawn blanks on visual and photo reconnaissance. This was why recent observations taken on the ground were invaluable. The target was still obscured and navigation would have no ground reference whatever. What it boiled down to was that it would be *my* job to find *Bobby*—or, rather, his little transmitter—among the polders and canals.

We met at the aircraft to stow the gear and check out the radios, and it was not long before we started on the taxi roll and moved to the active runway. Moments later, my instruments showed that we were climbing fast, and I connected the oxygen and my heated suit. It was not uncomfortable when we cleared our departure from England with air-defense radar and continued the climb to mission altitude, but when we reached it, the outside air was down to −56° F and I could feel the cold nibble at the exposed bits of skin around the oxygen mask. As a precaution I turned on the radio and the recorder to keep them warm. The boys up front were rather terse with their exchanges on the intercom; the crew could see the black, velvety sky sprinkled with diamonds and would be keeping their heads on a swivel looking for German fighters.

I was in a bit of a daze when the navigator called to report that we were 30 miles or so out of the target and would fly a dogleg to use up the time before the contact. He sounded like bullfrog because of the thin air, and I acknowledged with a similar croak. Then I gently lowered the antenna and made sure that everything was still working. Probably, *Bobby* was standing in some wet field down below, in violation of the strict German curfew, of course, checking his gear. The minutes went by slowly—too slowly to suit me. On the dot, I switched to the transmit mode and made the first call.

"*Bobby, Bobby* . . . this is Victor. Do you receive?"

On the third call there was a faint response, but I was not sure, and I tried to raise him again, asking for a short count. While straining to hear him I rotated the antenna in a slow sweep to see if I could pick up a stronger signal. After a few more seconds of flight I picked him up again at the end of his call, so I flashed the pilot to begin his orbit. The plane banked gently to the left as I went on the air again.

"*Bobby, Bobby* . . . this is Victor. How do you receive now?"

He came back to me saying: "I can hear you fine. How me?"

What luck, I thought. Here I am flying around like an angel and I've got a five by nine contact on the third try. *Bobby* should feel pretty good, too, so I asked him how he was doing.

"Hello, old chap," he

came back. "This is *Bobby*. Had some trouble making contact with our friends at first and the weather has been terrible. It is cold, too."

It hit me like a punch in the solar plexus a fraction of a second later. Did I hear him right?

"*Bobby*, say again. You're fading." I absolutely had to verify.

He said it all over again in just about the same words—without a bit of emotion—and I had it all on the thin steel wire of the recorder. *Bobby* had been taken. Six miles below me he was working his set with a gun at his head. From here on out the best I could do was to keep him on the air—and alive.

We went on with the contact and he began to pass me information on train movements, supply dumps, and the location of German units in his area. It would have been great stuff if it had not been manufactured data, or "chickenfeed," as we call it in the trade. He transmitted for close to six minutes or so and then I asked him to set a date and time for the next contact which I would confirm in the usual manner.

Just before I signed off, I glanced at the recorder and saw that in the intense cold the wire had broken. The take-up reel was one-third full and that was all. I told the pilot that we were through on my end and that we could go home. As we headed northwest I removed my glove and with a shaking hand tried to make some notes on my knee pad. When my fingers got so stiff from the cold that they wouldn't move, I gave it up and concentrated on remembering.

We were still at altitude heading for the North Sea when I heard a dull explosion on the starboard side followed by a seat-of-the-pants sensation that the plane was slowing down. There was a quick exchange up front (which I could overhear on the intercom) to the effect that we had lost one engine and had feathered the prop. The instruments confirmed the loss of speed and the slow descent. I turned off all my electrical equipment, trusting the old flashlight.

We still had to fly above the reach of the German flak batteries along the coast, and the altimeter was winding down until it showed that we were in the denser air. Adrenaline was pumping wildly as I reached for my parachute under the seat and rehearsed the procedure for bail-out—with the chest pack in my hand, fighting the slipstream. Of course, the whole plane could blow up or be hit, and the basic question would be quite academic. Over the frigid North Sea towards which we were still slowly descending, we had become night-fighter bait. That unpleasant possibility made me wish for the relief tube until we cleared our entry with British radar and were vectored to one of their emergency airfields on the left bank of the Thames River.

It was the smoothest landing I experienced in a Mosquito and not a moment was wasted in releasing the hatch cover as we bumped over the pierced planking of the taxiway and came to a stop. My exit was about as graceful as that of a grizzly emerging from his den, and this ridiculous performance was illuminated by the spotlights which a dozen or so emergency vehicles were playing on the crippled Mosquito. Since the machine gave no indication that it would blow up, I crawled back into my hole to retrieve the knee pad with my scribbled notes and the spool of wire on which technology had etched at least a part of *Bobby*'s message to me. Then, knowing in my heart that I would rather be an old and not-so-bold flyer, our crew of three was whisked by ambulance to the base dispensary for a checkup and a double shot of medicinal spirits...the traditional remedy against airman's fatigue, the bends, loose bowels, and other impairments of the mind which invariably follow a near crash.

We stayed together through the debriefing, but while my buddies were allowed to sack out, I was flown back to home base in a little Lysander liaison plane for an early morning tête-à-tête with my naval boss and a subsequent overland trip to London. Something had to be done quickly about *Bobby*, and we also had to know if Joan-Eleanor had been compromised by his probable capture. I am not sure what the priorities were.

I was tired, and today, so many years later, I have only a coarse recollection of all that happened in that soundproof conference room on Grosvenor Street, but my story was dissected in minute detail and they played that miserable short bit of wire I had brought with me. I got a bit huffy when I had to explain again and again to these nattily-uniformed gents that it is not good for one's health to light a cigarette near a pure oxygen atmosphere in order to anneal a piece of wire before knotting it, not to speak of other difficulties like heavy gloves, the ticking seconds, the excitement, and the simple fact that standard procedure goes out the window when a man's life is about to be blown away.

As we were exploring various alternatives, *Bobby's* life expectancy became very important to me, and I volunteered to make as many flights as they wanted over Zwolle in order to make contact and extend his false value to the Germans. At the same time they were going to energize the Dutch underground in an effort to get the whole story or at least to confirm what I felt pretty sure had happened to him.

If this were a piece of fiction, all kinds of happy endings could be invented... but it isn't. There were two more flights over Holland and both drew blanks. *Bobby* remained silent then, and is to this day. It is small comfort to believe that his last transmission is still traveling in space.

I flew my allocation of missions with Joan-Eleanor, which was not compromised, and a good many were productive. The flights took me as far east as Prague, to Berlin, Hamburg, to the rocket laboratories at Peenemünde, and to other targets until Hitler's Reich collapsed. Fresh information from our men on the ground combined with aerial photography was of great value at a time when traditional intelligence channels were too slow to fit a fluid situation.

Some thirty years later I read a modest reference to Joan-Eleanor in a declassified report on the wartime activities of the OSS. It indicated impersonally that the project contributed to the war effort. That was after the fact, however. At the time of which I have written, I was concerned only about keeping the radio going while imagining the pyrotechnics on the ground through a lattice of moonlit vapor trails. ■

Editor's Note: Readers of 73 have met Victor Layton before—but didn't know it. He was the secret agent, *Citron*, referred to in "Messages from Station Charlie," 73, January, 1982, p. 92. He and the author of that article will have had their first reunion in 41 years before you read this.

Charles Houghton WB6IGP
6345 Badger Lake Road
San Diego CA 92119

Build a 1296 Stripper

Join the fun on 1296 MHz with WB6IGP's stripline downconverter.

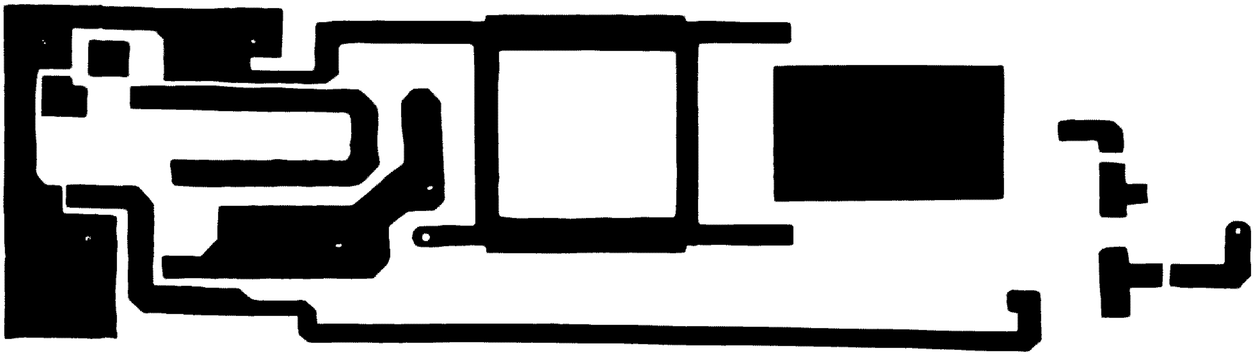


Fig. 1(a). Printed circuit foil pattern, actual size.

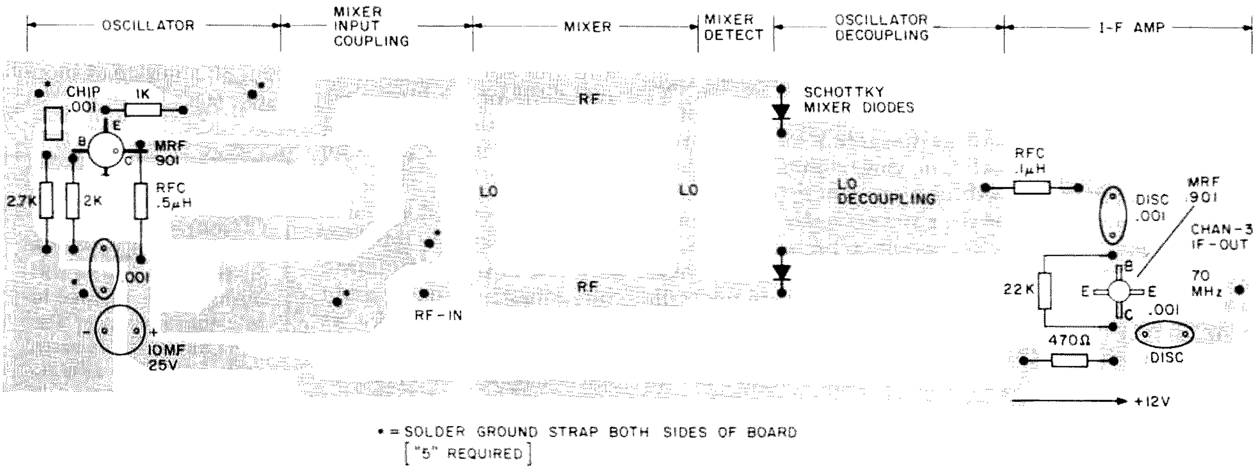


Fig. 1(b). Parts placement. Coax connectors are mounted on the ground-foil side. Provide clearance through the PC board so that center conductor does not ground out.

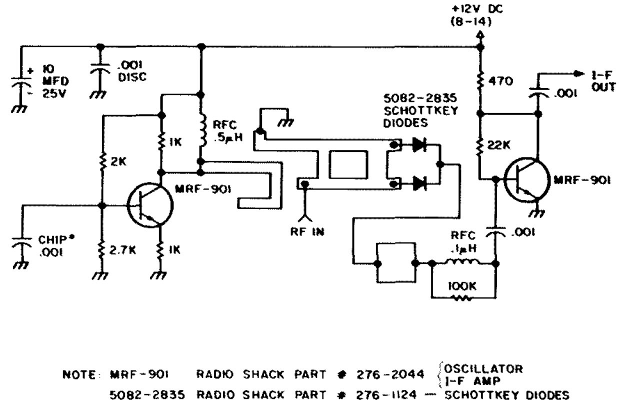


Fig. 2. Schematic diagram.

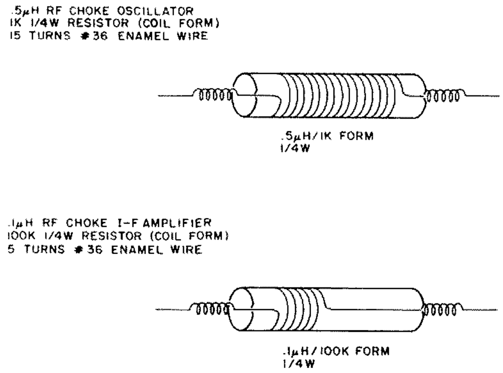


Fig. 3. Chokes.

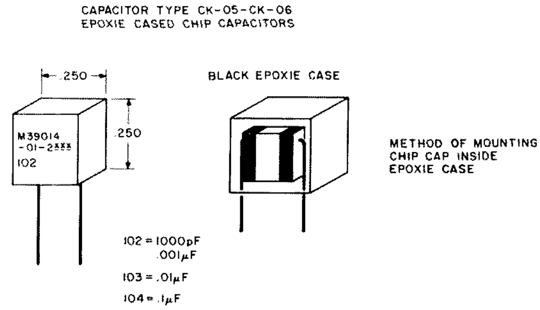


Fig. 4. Types of chips.

Here is a microwave converter that is easy to construct and operate. This design removes the bulky oscillator-multiplier requirements and places all components on a single printed circuit board in stripline fashion. In this manner all of the critical inductors are etched onto the board and do not require tuning except for the oscillator circuit. Several stations locally have constructed this unit and have found it to be trouble-free.

The design goal was to create a workable unit that could be constructed in any part of the country using local parts suppliers such as Radio Shack. The one critical component on the PCB is the chip capacitor on the base of the oscillator transistor. This capacitor is essential to the proper operation of the oscillator. I have had trouble with units constructed using other than disc-ceramic capacitors. They just don't work at this frequency, so don't substitute any other capacitor; the stability and frequency of the oscillator depend on it.

Where most capacitors fail is with the inductance in the leads and the package used to contain the capacitor. The chip capacitors are leadless, limiting the series inductance to a bare minimum. (See below for tips on how to scrounge at local swap meets to discover chip capacitors in some very unlikely spots!)

The transistors used were Motorola MRF-901 and were obtained at the local Radio Shack store along with the Schottky mixer diodes. Other devices could be substituted, such as the NEC-02136 oscillator and the NEC-02135 amplifier, depending upon suppliers available. The remaining parts can be obtained from the junk box or surplus PCBs—to hold down costs.

The resistors should be ¼ W. Either long or short leads will work just fine. There are two rf chokes that need to be wound first. Select smooth ¼-W resistors to wind the chokes on as winding on them is a lot easier than on film types, which tend to bulk the windings near the center of the resistor body and make attachment of the wire ends a little loose. If you do use film types, coat the chokes with a good quality "Q" dope to hold the windings distributed on the resistor body securely. See Fig. 3 for details.

Make sure you have removed the enamel coating on the ends of the wire so as to ensure a good connection. I have lightly held a fine grade of sandpaper and pulled the wire through it. Light pressure must be used or the wire will break. Another method is to dip the wire into some rubbing alcohol, remove the wire quickly, and hold it in a match flame to remove the enamel. While the wire end is still hot, dip it into the alcohol again and it will be bright and shiny and ready for soldering. (I used about one-half ounce of alcohol in a small tip-proof container.)

Concerning the chip capacitor, many printed circuit boards should be looked over for suitable capacitors that may be hiding chips. Look for the little square types, usually black, about one quarter of an inch square. These are capacitors embedded in epoxy with wire leads attached. With a little patience, the capacitor can be removed from this epoxy prison. I have used diagonal cutters to slowly chip away the sides and the top of the unit. The front and back can then be pried off with a sharp edge or the diagonal cutters. See Fig. 4 for details.

Mount the resistors first and then the rf chokes, checking them for continuity. Then mount the chip capacitor. You might want to hold it down with a toothpick until one side is soldered into position. Mounting the diodes and transistors last will protect them from abuse. Do not forget to connect the points marked with a dot to tie the sides of the foil together. This connects the rear ground surface to several points on the PCB; use scrap pieces of solid wire.

The transistor used for the oscillator should be modified by cutting one of the emitter tabs off close to the case of the device. (If the NEC-02136 is used, no modification is needed as it comes as a three-lead device.) See Fig. 5 for details. Do not modify the device used for the i-f amplifier. Both emitter leads are inserted into the hole between the base and collector stripline. The emitter leads are then soldered to the rear ground foil.

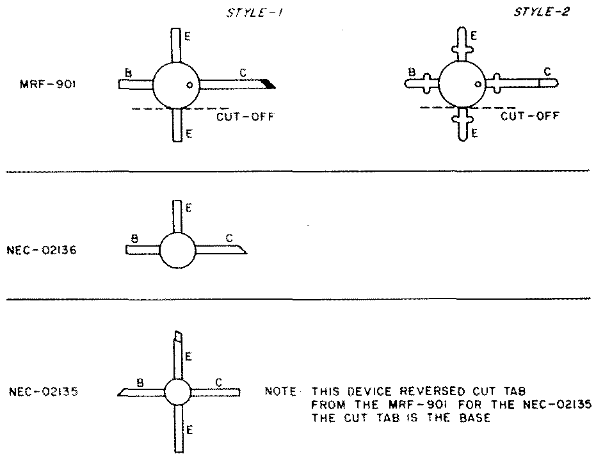


Fig. 5. Oscillator transistor.

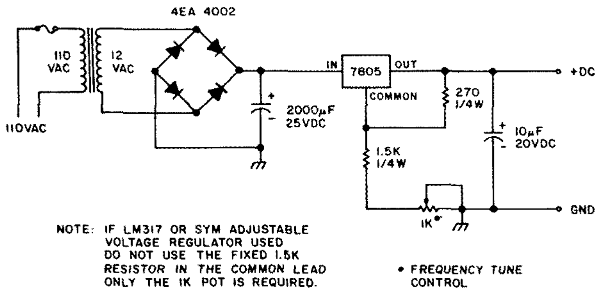


Fig. 6. Power supply, 8–14-V-dc adjustable.

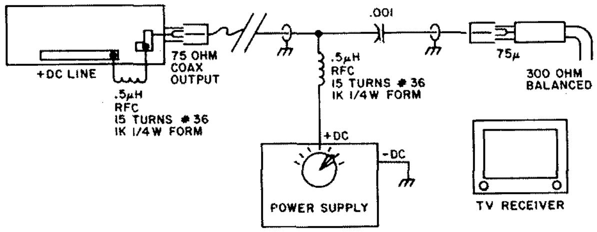


Fig. 7. Power feed for remote operation.

Construction of the power supply is all that is needed now to place the converter into operation. A printed circuit board was not used as the components were mounted on terminal strips. See Fig. 6 for details.

Operation with the fixed-voltage regulator is modified to provide a variable dc-voltage output of about eight to twelve volts. By placing a resistor in the common lead of the regulator to ground, the voltage can be adjusted from its lowest regulated voltage to some higher value. While high output current cannot be obtained with fixed regulators, they can provide the amount needed for this application. (A variable regulator could be used but they are about four times as expensive.) Ten volts will adjust the converter to the designed center frequency you desire.

The oscillator, on its fundamental, is adjusted by changing the length of the collector stripline. Output frequency depends on components used and the lead dress. Nominal frequency without changing the stripline is about 1050 MHz, and is 1400 MHz with a very short collector stipline. Coupling out of the oscillator is accomplished by a short section of transmission line (stripline) to the upper arm of a microstrip branched-arm, 30-dB, hybrid mixer. The upper arm and lower arm are resonant to the incoming rf signal, while the side left and right arms are resonant to the local-oscillator signal.

This frequency is about 1220 MHz when the converter is turned to 1290 MHz. Schottky diodes are used in the mixer due to their low loss and low noise figure. The rectangular stripline on the diode output decouples the microwave frequencies (1280 MHz, 1150 MHz, and 1220 MHz) and passes the i-f signal on to the preamplifier. This amplifier provides about eight dB of gain. Connection to the television receiver is made with a 75-to-300-Ohm balun.

While the converter can be kept in the station proper with a direct connection to the power supply, it also could be mounted up on the antenna with a small modification and a suitable weatherproof box. The converter is modified by placing a 0.5-microhenry decoupling choke from the positive dc strip to the i-f output connector. In the station end of the coaxial cable another 0.5-microhenry choke is placed from the center connector of the coaxial cable to the power supply. The coaxial ground sheath is tied common to the system ground and the power-supply negative output. The coupling to the television receiver is through a .001-uF-dc blocking capacitor. See Fig. 7 for details.

Testing the converter can be very easy if a signal generator or an on-frequency signal is available. If not, then you will need to set the oscillator frequency with a frequency counter. The only other method is the cut-and-try method; not too scientific, but it can work. Adjustment of the oscillator need not be difficult as long as some means is available to check frequency or observe a signal.

When power is applied to the converter for the first time (and all is well) you will observe very heavy snow on the TV screen. Confirm this by turning the power on and off to observe the difference; it should be quite apparent. Without test equipment, this is the easiest test to tell if the system is working. The snow is the result of the local-oscillator feed through the mixer and i-f amplifier.

Adjustment of the local oscillator is next. Set the power supply to mid-range (about ten volts). Then start trimming the collector stripline, 1/32 to 1/16 of an inch at a time for the first or second cut, until you get the feel of how much frequency is changed on each cut. Go slowly! When the frequency is within 50 MHz or so start trimming in 1/64-inch increments. If at any time you have used a soldering iron on the PCB, postpone frequency measurements until the board has returned to room temperature—about fifteen minutes maximum.

If you rush this step and mount the converter on the roof, you may find out later that the frequency is so far out of range that the converter is unusable. Go slowly, and the adjustment will come out right the first time.

Adjustment of the power supply should vary the voltage to the oscillator and i-f amplifier, shifting the frequency of operation plus and minus 20 MHz, depending on power supply swing voltage. The voltage swing does not affect the performance of the i-f amplifier as long as the voltage does not go below 5–6 volts. I do not recommend operation at this low

voltage as the system becomes unstable. The oscillator stability is quite good considering it is a free-running oscillator. It will drift with changes in temperature, but slight adjustment of the power supply will correct this.

A further development of this system can be to incorporate a phase-locked local oscillator providing the required stability needed for single-sideband operation on 1296 MHz. The prototype unit that I have constructed requires extensive metal work for shielding between the phase-locked circuits and the local oscillator. I am trying to provide this circuit in the same manner that this converter was constructed, possibly on a two-layer PCB to eliminate the milling work. But that is another story.

I hope that this project will provide you with the many hours of enjoyable operation that it has me. Construction of this converter is easy. Not that it will build itself, but with the stripline construction, all of the critical inductors are etched on the printed circuit board. In constructing your own PCB, the dimensions should be held to 1 to 2 percent for commercial purity. I have found that I could vary up to 5 percent (about fifty thousandths of an inch) before my equipment could detect any change in system performance at this frequency.

For those not desiring to construct their own printed circuit boards, I will provide one for five dollars plus postage.

I would like to correspond with interested parties concerning this project or other related items. Please include an SASE for a prompt reply. ■

Bill Pasternak WA6ITF
73 Staff

Looking East

Silver Eagle award-winner Bill Pasternak recalls his 25-year relationship with W2NSD and 73.

There's an old adage that says: "Time flies when you're having fun." Well, the past 25 years have gone by rather quickly, so I guess I have enjoyed them.

I first met Wayne Green W2 Never Say Die in 1960. I have told this story before, but it seems kind of apropos that I repeat it once more. It was late summer and I was at the home of my buddy Larry Levy WA2INM when John, then WA2FMF, and the red wagon showed up. John was very excited. His little wagon was going to appear in a new amateur-radio magazine. "What new amateur-radio magazine?" asked INM as he put down the glowing red Wen soldering gun.

John explained that he had just left Wayne Green W2NSD, who lived several blocks away in the Flatbush section of Brooklyn. John had been talking to Wayne on 2 meters, and since he didn't want to interrupt the QSO and he didn't have a car, he loaded his Gonset Communicator III, an automotive battery, and a halo antenna onto a kid's red wagon and wandered the mile or so over to the Green QTH. Keep in mind that this was the pre-HT era, and going portable meant taking a husky power source along with you.

As it turned out, WA2FMF happened upon Wayne at a time when W2NSD was looking for material for a new ham magazine, so out came the camera and John's "Little Red Wagon Mobile" was captured on film for posterity. John's next stop was Larry's QTH, probably because he knew that Larry's dad would drive him and his gear back home. He did.

It was the following Saturday or Sunday that I had my first visitation with W2NSD. John and I were again at Larry's house. As usual, WA2INM was busy inventing something. It was a bit after lunch when we decided to go visit Wayne. Not having vehicular transportation—Larry's father Max was out—we walked the half mile.

At that time, Wayne lived on the top floor of a two-family house, but the place had anything but the look of a home. If it had to do with the publishing business, it could be found in the W2NSD castle. If it had anything to do with amateur radio, it was there as well. It was at this point in my young life that I learned that there was more to ham radio than turning on my rig and talking to Larry, John, and several other locals.

Wayne was about a month from his self-imposed introductory date for *73*. Manuscripts were everywhere. I cannot remember if there was a desk or not. What sticks in my mind is the typewriter on the floor, with papers piled high sitting next to it. I have a feeling that's where Volume I, Issue I was pieced together. The other very vivid thing in my memory is a gigantic mosaic tile taking up the entire floor of one room. That mosaic would grace the front cover of the magazine several months later.

I suspect that much of this first meeting is so well ingrained in my memory because it transpired only a week or two before my mother passed away from a bout with cancer. During the week, my job was that of caring for her while Dad was at work or trying to get some needed sleep. I would sleep when I could, mainly in the afternoons after my younger brother got home from school. It was a waiting game, a grim one at best, and the only time I could escape from it was on the weekends when Dad took over and I would spend a day or two with Larry and his family. They were my "other mom and dad."

I lost track of Wayne and *73* for the next few years. I had promised Mom I would attend college, and I really gave it a try. I gave it two years, but that was about all I could take. I was, to say the least, bored stiff. I had always been brought up as a "doer," and being a "learner" never had been my style. So I walked away from higher education and into the business world, bumping from TV repair to TV and radio production (mainly the former).

In the meantime, I again crossed paths with W2NSD in a rather strange way. Larry was away at college and I had just become an active ham again. I was living on my own and frequently visited the Levys. It was on one of those dinner visits that Wayne passed by Larry's house to pick up something or other. For some reason, I had been on the *73* "comp list" since the first issue, and I remarked to Wayne how well I thought the magazine was coming. I really had no basis for comparison, since my subscriptions elsewhere

had lapsed long ago. I noted to W2NSD that I had just completed designing a new 6-meter converter because nothing on the market met my needs. After describing it, he said, "Write it up and I'll publish it." I did, he did, and that began an ongoing 23-year formal relationship with *73* that has lasted until this day.

In the intervening years I mainly wrote product reviews and commercial-gear modification articles, and it was not until 1971 that I began another literary aspect of my life—writing a monthly column. It all started innocently enough. Larry and I were winding down our three-year business and I was planning a move to the west coast. Larry and I had a rather strange business that developed "disco light shows," but we subsidized this by doing television and stereo repairs. Two of our customers were Wayne's parents. We had their color set in the shop for some much-needed TLC. Wayne had already moved to Peterborough several years earlier, but he came into town regularly to see his mom and dad. When he found that we had taken their TV to the shop for repairs, he wandered by to see what was up. It was in the course of our conversation that I told him I would be heading west the following month, and he said that I should document the trip and my arrival for *73*, paying special attention to the 2-meter FM activity I encountered en route.

Several months later I finally got around to writing the article he had requested. It was my first attempt at editorial journalism, and to say that it was bad would be an understatement. The article was returned with a note that simply said: "Try again—Wayne." So I tried again, but rather than write an article about the trip, I wrote about the treatment afforded a newcomer to a strange land. I titled the article "Looking West," and apparently the boss liked it. It appeared in the March, 1972, edition of *73*.

"Looking West" was never intended as a column. That's why there was no April or May version of it that year. It took that long for W2NSD to convince me to write another "episode," since it was apparent that those who read the magazine had a desire to find out what the Southwest was doing FM-wise. Well, the Southwest in general and the Los Angeles/San Diego rf corridor was doing quite a lot, and I had arrived at just the right time.

Only a week before my arrival, the Southern California Repeater Association had been born out of the ashes of the old California Amateur Relay Council, and 2-meter frequency coordination was coming to the Southwest. This was the obvious topic to follow, but I wanted to add some human interest to the "cold facts." The best way to do that was to join the Southern California Repeater Council and get to know the people involved.

I had been turned off to repeater councils several years earlier by the heavy-handed tactics of the now-defunct Northeast Repeater Association, but unlike the NRA the people running the SCRA appeared to be very warm and open-minded. I joined so that I could be a snoopy news reporter on the inside, but I wound up splitting my free time for the better part of a decade between helping to guide the SCRA and writing "Looking West."

It was directly as a result of "Looking West" and *73* that my career took a sharp turn in 1974. It happened at SAROC in Las Vegas. I was there, Wayne was there, and so was a mutual friend named Dave Bell W6BVN (now W6AQ). I had met Dave a year earlier when he called and asked if I could pass by his studio and look at a TV set. It seems that W2NSD had told Dave that I knew a bit about those beasts. I was unaware that Dave Bell was a filmmaker, even though I had seen his *Hams' Wide World* numerous times. Who ever looks at the credits, right?

Well, it was at SAROC '74 that Dave started picking my brain with regard to a new ham flick he was thinking of doing. It was the era of the CBer, and the image of hams was being smothered by "10-4, good buddy." Dave's concept was a short documentary that would explain the difference between the two services and also try to capitalize on the widespread interest in personal radio by converting CBers into hams.

SAROC was not a good place to talk, but I agreed to send Dave my thoughts on the matter. I did and became involved in the production of the film, *Moving Up To Amateur Radio*. My life would never be the same after that. In 1979, Dave asked if I would coproduce another film about amateur radio with him. I was both honored and flabbergasted. My expertise was in the technical end, not the creative, but Dave insisted that we meet for lunch and talk about it. The end result of that meeting would become known as *The World of Amateur Radio,* and within a month or two of completing that film, I literally walked out of a high-paying job I had held since my arrival in Los Angeles and reentered the broadcasting business, where I remain today.

1983 and 1984 brought the team of Dave Bell, Roy Neal, and Bill Pasternak back together again for one more ham production titled *Amateur Radio's Newest Frontier*. In this case, the positions were rearranged a bit, with Roy Neal K6DUE as the Executive Producer. A new element was added as well—videotape. Until *Amateur Radio's Newest Frontier*, all ham-radio productions had been done on 16-mm film and were eventually transferred to tape. *Newest Frontier* changed all of this by taking modern teleproduction into the field nationwide and capturing the entire story on tape.

Today I am employed as a Broadcast Engineer Specialist with the Metrotape Division of Metromedia Radio and Television in Hollywood. That's a long, long way from the streets and back alleys of Brooklyn. I continued writing "Looking West" on a monthly basis until 1982, when I became the editor of the old *H.R. Report*, which was renamed *Westlink Report*. Something had to go, and it was "Looking West." Not that it gave me much more time, since in 1979 I had taken over a small on-air bulletin service called the Westlink Radio Network from Jim Hendershot WA6VQP. It was then a local Los Angeles repeater news bulletin, designed to serve that market primarily.

Well, as most of you know, today the Westlink Radio Network is still going strong, with automated telephone distribution points nationwide and an all-volunteer staff of 44 hams around the world. Every Thursday evening a new newscast is recorded, edited, and put on-line by Friday afternoon. This happens 52 weeks a year, and with my other activities, it leaves little time for play. In fact, my on-air activity is confined these days to a pair of repeaters on 220 and 450 MHz while going to and from work, but I really don't mind it.

I really owe a lot to the Amateur Service and to *73*. Both are directly responsible for the way my life has been guided, and I consider myself successful. Yes, it's been a good 25-year relationship between this writer and *73*. Time does pass quickly when you are having fun.■

Irving M. Gottlieb W6HDM
931 Olive Street
Menlo Park CA 94025

Old Tubes Never Die!

Discover the romance of glowing filaments.

Imagine, if you will, the interpretations of archaeologists digging through the rubble of our remote civilization some three thousand years hence. You can bet your boots they will transpose the evolutionary sequence of tubes and transistors. The intricacy, precision, and sophistication of the tube's mechanical structure will suggest itself as the product of a more mature technology; the transistor, by comparison, featuring an uninteresting pellet of impure silicon will likely be assessed as the stage immediately following the crystal and cat whisker.

As for ICs, they may well come across as the artistic artifacts of our mysterious culture and some will doubtlessly be assumed to depict long-forgotten religious symbolism. One can further speculate that the tube will be cited as evidence that we had successfully made the long transition from the pastoral to the industrial society.

Conjuring up such a scenario is not too farfetched. But, indulging again in a brief imaginative interlude, can you envisage collectors of transistors in the sense that there are *tube* collectors? Granting that the point-contact transistor and perhaps the first junction transistor must have intrinsic collector's value, the collection and display of transistors would evoke less interest than a good collection of match-box covers, bottle caps, or Burma Shave rhymes. Old tubes fairly wreak with nostalgia, and to the fervent initiates who collect them, an aura may be beheld around them and an intoxicating odor may be sniffed.

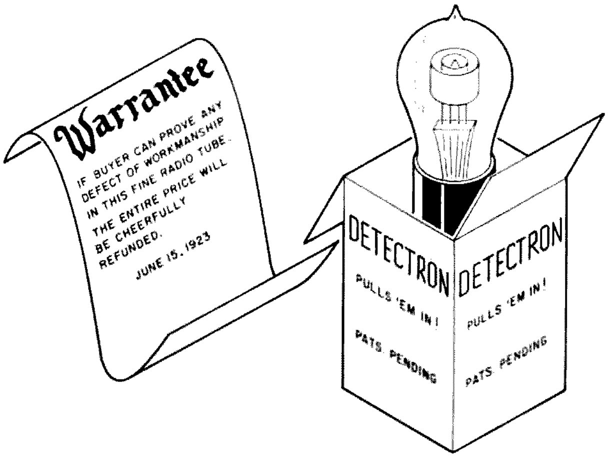


Fig. 1. Collector's delight—a "brand-new" oldie in its original carton! Like working a rare DX station, this is a hoped-for occurrence that you shouldn't hold your breath in anticipation of.

Merely holding one of these venerable devices of the past brings exotic delight to the dedicated tube collector. Thus, it is not surprising that there is no great fetish about the operational condition of these tubes. To be sure, an intact filament does enhance value, but many are available to collectors just because someone once thought the proper resting place for a defunct tube was the trash pile. An owner of a rare specimen is often quite reluctant to test it in any way. To be able to say that a tube is "probably" good often suffices in negotiations.

Although the tube collector is ever in search of an "original" De Forest audion, there are hundreds of early types which also are highly esteemed. These include both receiving and transmitting tubes. The tube collector looms up as the chief villain in the eyes of the hobbyist who gets his kicks from reviving antique radio sets. Hoarding of the O1A, 99, and other tubes used in these radios means that tube prices are continually escalating. Inasmuch as these sets are usually sold *without* tubes, their restoration expense invariably exceeds one's naive expectations. Some O1A tubes are suspiciously modern in some constructional details. Such "bootleg" tubes may not be bad for the antique radio fan, but there is the prevailing danger that the serious tube collector might pay dearly for a fake Rembrandt!

You, Too, Can Be A Tube Collector!

To get started as a tube collector, you should acquaint yourself with some of the types that are presumed to have inordinate value. This will help you avoid cluttering your collection with tubes of little value. It is not always age, per se, which dictates a tube's value. Rarity, unusual structural aspects, and a tube's impact on technology all enter into the equation.

As with automobiles, there is also an elusive factor mysteriously based on little-understood psychology. Why is a 1965 Mustang able to command four or five-thousand bucks from auto buffs while a very similar Chevy of that year generally peddles for several hundred? We find it futile to resolve such dilemmas—it is easier to just accept them. In similar fashion, some tubes appear to be more exciting to the collector than others. Whether Freudian operatives or other subliminal factors are involved is not really of great importance; it is necessary only to appreciate that, like classic paintings, some tubes perform better at the auction than others.

A wonderful book on the evolution of tubes was published by Howard W. Sams

in the mid-seventies. Entitled "The Saga of the Vacuum Tube," it was written by Gerald Tyne. It contains numerous photographs, descriptions, and stories about tubes and obviously represents a masterful research accomplishment by the author. The book itself is a classic. Unfortunately, its publication occurred at a time when the electronics community found itself caught up in the overwhelming frenzy of computers and digital logic. This publisher then began cutting back on treatises dealing with such "obsolescent" topics as analog circuits and vacuum tubes and this marvelous publication was discontinued.

At ham flea markets it is a common spectacle to see strange old tubes which people gawk at but do not buy. That is because they see no use for such a tube in their present 2-meter rigs. This scenario often is recognized as a veiled opportunity by the knowledgeable tube collector; it is this because the vendor gets tired of exhibiting it to hundreds of cowards who can't muster up the courage to make a bid. If you are both a gambler and a tube collector, hold off any action until the vendor is ready to close shop. That is the time his psychological Achilles' heel will be exposed! The gamble, of course, is that someone as bright as you but a wee bit faster may beat you to the punch. At the worst, you will have had a lot of fun, and you can solemnly vow to do better next time!

Be Patient—Wait Until the Moon Shines Blue.

Once in a blue moon you will stumble upon a rarity of rarities, a hard-to-find antique tube in its *original* box! The inference here is that the box has never been opened and, of course, the tube never used. Whether such a near-impossible situation actually enhances the tube's value to collectors varies with the type of tube and with a collector's attitude. Always seek a number of opinions before releasing such a find at a giveaway price if you are in the hobby to collect profits as well as the tubes themselves. In some instances, an original tube carton can command a respectable cash premium.

It is also interesting to read the old literature and to contemplate the buck-and-a-half or two that many tubes originally cost. Along with gold, art, and jewels, maybe the financial wizards who tell us what stocks to buy and when should advocate a tube collection as an inflation hedge. Inasmuch as their other advice fails to make us rich, their reputations can hardly be said to be at stake.

Even if the box has already been opened, as most probably will be the case, its association with the tube is a value enhancer. Don't obey your knee-jerk impulse and toss tube boxes in the junk-mail depository. When you swap or sell, the phrase, "in, or with, its original container" has magical qualities—it strengthens your negotiatory position. This is true even though collectors generally remove tubes from boxes and mount them for display.

Darwin Would Have Gone Bananas over Tubes

Few of life's trials are as likely to provoke the crocodile tears from the grizzly-faced old-timer as remembrance of the many fine tubes which sparkled for a time in the sun, then silently evaporated into the mists of obsolescence. As with the Pierce Arrows, Reos, Hupmobiles, and Willy-Knights, they came and they went. Although little more than mere numerical designations to many, the ham of yesteryear made the most of his 46s, 2A3s, 57s, 45s, 56s, 53s, 6J5s, etc.

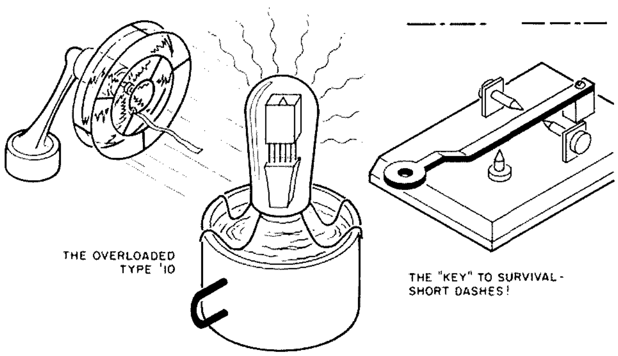


Fig. 2. CW transmitters using type 10s were sometimes hard to copy—the dashes were too short! Only short dashes were permissible from a de-based 10 operating in a cup of transformer oil at 700 volts on the plate and nine volts on the filament. Plate current was about 10 mA below the value which could cause instantaneous destruction.

That oblivion would be the ultimate lot of these and many other venerable bottles was unthinkable at the time, but by the time the 6L6 beam-power tube arrived on the scene, it was evident that Darwin's theories were manifesting themselves in a long succession of evolving tubes. Succeeding tubes would displace previous ones because of very specialized abilities. And there were mutations, too. For example, out of nowhere sprouted the screen-grid. This abrupt transition left no missing links. The corollary in nature would be the reptile which crawled on its belly only to give birth to flying creatures. (Or was it the other way around?)

Modern designers are wont to complain that before they get their systems off the drawing board, the ICs have been superceded by newer or more sophisticated devices. But *tubes* in their heyday moved mighty fast, too. For a while there was the O1A and its "peanut" counterpart, the 99. But you couldn't just sit on your duff and keep up with the technology, for soon there were tubes with indirectly-heated emitters which permitted ac operation. And the introduction of the screen-grid tube triggered an array of multi-electrode and multi-function tubes.

De Forest expressed delight and astonishment at the evolved versions of his original device. Pentodes, triodes, and diodes were packaged in a single envelope, and some TV tubes went considerably beyond this. A couple of class-A audio Watts from a pair of 45s was for a while the last word in sound reproduction, only to be supplanted by the 47 power pentode, which in turn gave ground to 46s in class B. And so on up the ladder until apartments groaned under the acoustic burden of many tens of Watts from cheap radios and stereos. But, although it may have been a far cry from the tacky O1A to a sophisticated pentagrid converter, mere technical fanciness does not qualify a tube as a worthwhile collector's item. It's that unique blend of vintage, rarity, technical importance, and the elusive charismatic factor previously alluded to.

Transmitting- and receiving-tube collections are generally kept separate, although not necessarily. Early transmitting tubes were not significantly distinguishable from receiving tubes insasmuch as they had power ratings on the order of five Watts. Of course, many amateurs cut their eye

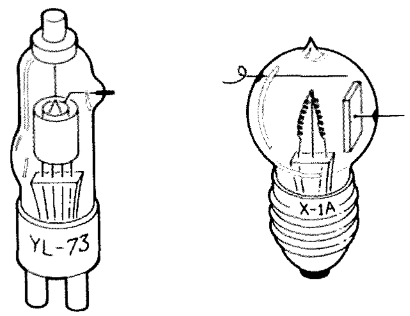


Fig. 3. On the left, a 1934 YL-73—$300 down and $37.50/ month for five years. Special discounts in lots of 25. On the right, an X-1A, circa 1899, only five tubes made, pre-De Forest control element—$3.50 or best offer. Elusive factors surround tube collectors' value appraisals. Rarity, vintage, and technological level are not the only considerations influencing perceived value.

teeth on the venerable 210, a so-called 7-1/2 Watter. This tube was to transmitting what the 01A was to receiving—a universal workhorse. And *work* it did; it is almost shameful in retrospect to recount the power inputs some hams pumped into those abused but obliging bottles. But soon enough, the tube manufacturers got the message.

Response to Overloading

As may be suspected, a host of tubes became available, making it unnecessary for the ham to drive the pants off the 210, not to say anything about 45s, 46s, and various receiving tubes including even 71As and 201As. Many of the "new breed" of transmitting tubes were actually electrically-ruggedized 10s. Included therewith were the Taylor T20 with a nice isolantite base and with the plate lead eminating from a cap on top of the tube, the RCA 801 with more "realistic" specifications than the old "ten," and a Sylvania special with a long graphite plate, making it look more like a fifty Watter.

It wasn't that transmitting tubes were not available, but there was a gap in the power ratings between flea-power level and several hundred Watts. What the average ham needed was an inexpensive tube capable of filling this gap and which would allow the kind of reliable operation never really attained via the overload route. A plethora of dedicated transmitting tubes poured forth from the various manufacturers, some of whom got their foot in the marketing door this way. These tubes had power-dissipation ratings of several to many tens of Watts and featured quality insulation, hard vacuums, rugged filaments, and, often enough, shapely contours. After WWII, many of these tubes yielded their popularity to the 807 family of beam-power tubes and since then have been more common on collectors' display racks than in transmitters.

It is hard to underestimate the provocative effect that hams' overloading practices had on intermediate-power transmitting tubes. The lowly 210 wasn't the only victim of such abuse. Thus, an advertisement by the upstart Eitel-McCullough Company in the 1937 *ARRL Handbook* shows a picture of one of their 150Ts with a sizeable hole burned in the tantalum plate. The ad tells you that this damage was produced by a twenty-to-one overload factor of 3000 Watts! You are further informed that no gas was released within the tube as a consequence of this tremendous overload.

In another ad in the same publication, Taylor Tubes informs would-be ham customers that it is no longer necessary to overload 210s because of Taylor's introduction of tubes with power ratings *between* the 210 and the 203A, which can dissipate a nominal 100 Watts. Relevantly, Taylor seized the opportunity to list also its souped-up HD-203A, which sported a carbon anode and a 150-Watt dissipation spec! Finally, a more conservative ad by Heintz and Kaufman lets you know that their Gammatron transmitting tubes are just that—conservative. These ruggedized rf power tubes were built to endure the hardships of the commercial world and even to forgive the engineering sins of hams.

Did We Appreciate Tubes?

The tube collector may resemble collectors of other items superficially. It should not be supposed, however, that they see tubes as obsolescent devices stomped over by the relentless march of progress. *Individual* tubes, they will acknowledge, have been superceded by better devices, but no true-blue collector in his heart of hearts believes that vacuum-tube technology is passé. For the time being, the semiconductor fad is in full sway, but just look at the very significant advantages of tubes:

- They are extremely forgiving to overloads and abuse.
- You can see what's going on—a lit filament tells you something. A cherry-red plate tells you something. Also, you can learn from bluish glows, incandescent grids, and internal arcs.
- Plugging and unplugging tubes is a heck of a lot easier than fighting a solid-state device loose from its PC board.
- Not that it probably matters, but the "old-fashioned" tube is much more resistant to damage from an electromagnetic pulse than are solid-state devices—especially ICs.
- A circuit configured around tubes is easier to test than one with solid-state devices; even with a low-voltage ohmmeter, leakages and reverse-conduction phenomena can be hard to interpret. Damaged or "sick" semiconductors may or may not be detected with ohmmeter checks.
- Tubes exhibit fewer problems with ambient temperature variations.
- Tubes have done things not yet really duplicated by solid-state devices. Consider the electron-coupled oscillator, the transitron oscillator, the tuning-indicator tube, the cathode-ray tube, or the gated-beam tube.
- Although it cannot be measured, weighed, otherwise quantified, or even proven, tubes can be *charismatic*, and often exude mystique and romance! If this contention sounds foolish, it would smack of greater foolishness yet if it were made about semiconductor devices. Many a ham has called a faint DX station while hypnotically watching the dots and dashes form in the eerie blue glow of his 866s, or in the varying light emission from his final-amplifier filament. And there is something about watching your modulated amplifier plate change color as you whistle into the mike that bespeaks of an intimate relationship between man and machine.

No Dog Forgives Better

Of all of the foregoing attributes of tubes, the first is probably the most important to the tube enthusiast turned tube collector. Consider, for example, the use of full-wave rectifier tubes in a typical power supply. Tubes that quickly come to mind are the old type 80 and its descendants, the 5Y3 and the 5Y4. If a filter capacitor shorted out in such a supply,

the plates of these tubes would become red-hot and solid hunks of oxide material might be torn from the surface of the filament. The filament might even be bent out of shape from the force of the inordinately heavy current demand.

All this time the power transformer is smoking and exuding odors suggestive of the last burned steak served at your favorite restaurant, and by the time you turned off the power, that poor tube would show unmistakable visual evidence of having been through the mill. And it would rattle when shaken, like a bad light bulb. But, surprise of surprises, it willingly resumed operation once you replace the defective filter capacitor.

What does that tell you? Nothing, until you compare the situation with what happens to semiconductor rectifiers under similar circumstances. Of course, such abuse does not prolong tube life and it cannot be truthfully said that tubes are zap-proof. But it may very well be that we really didn't fully *appreciate* the true worth of tubes when they were more commonplace!

It is popular to allude to the numerous transistors that can be real-estated on a single IC chip and to tout the multi-functional accomplishments of ICs, but the tube collector recalls all of the fancy things done with multi-element tubes. And, of course, there were multi-tube tubes, too. These culminated in the compactrons used in TV sets. When you gazed down at the chassis of such a TV receiver, the large tube complement common to older sets was conspicuous by its absence. What you saw was just a few compactrons and a few conventional tubes. The compactron, in other words, was a vacuum-tube integrated circuit in its own right! If you are tube collecting, be sure to keep an eye open for some of these specimens!

Remember that Silicon Can't Do Everything!

Now and then one sees semiconductor circuits which are alleged to be solid-state versions of some unique vacuum-tube circuit. Upon closer inspection, the claimed analogy becomes quite tenuous, however. A case in point involves several references to "electron-coupled oscillators" appearing in the ARRL *Radio Amateur's Handbook*. If you refer to Fig. 10-B on page 6-6 of the 1980 edition, you will see a JFET Hartley oscillator so-labeled and described in the text.

By no stretch of the imagination do you have the desirable situation here that was forthcoming from a "true" electron-coupled oscillator using a screen-grid or pentode tube. In the tube circuit, output was taken from the plate but the oscillation was produced in the screen-grid, control-grid, cathode portion of the tube—the plate merely picked up the rf-modulated electron beam. This meant that the plate circuit was not load-sensitive. It was very much like taking the rf output from a good class-A buffer amplifier. Contrarily, the "hot-cathode" Hartley oscillator shown would require an actual buffer amplifier to prevent its frequency from being pulled by load variations.

There are other things you can't do with semiconductor devices even though they are loosely spoken of as the equivalents of certain tubes. For example, the VR (voltage-regulator) tubes could be used in simple relaxation-oscillator circuits for generating sawtooth waveforms in the audio-frequency range. Zener diodes simply will *not* serve this purpose, however. The VR tubes were filled with various noble gasses and exhibited hysteresis—that is, ionization and de-ionization voltages were different. In the zener diode such a difference is not encountered.

Admittedly, this is advantageous for the intended function—it precludes the possibility of inadvertent relaxation-type oscillations. Those who have had experience with VR tubes will recall such behavior. (It may also be recalled that earlier VR tubes were sometimes reluctant to start in the dark.) Even when not "relaxing," VR tubes produced a lot of noise that often fouled sensitive circuits. Maybe they would have suffered extinction prior to the solid-state invasion.

Notwithstanding the shortcomings of VR tubes, they have become game for tube collectors. Their eerie pink or purple glows are sometimes demonstrated by actuating a push-button switch on the collector's mounting board. But one can anticipate a blue-glowing moon when collectors pridefully display their array of zener diodes!

Perpetual Motion and Inventing a New Tube

Anyone who has played around with tubes to any extent has a number of pregnant inventions gestating in his deep subconscious. The only trouble is that you will invariably find that these ideas were most probably already given serious attention during past eras. Even worse, it is most difficult to conjure up any tube innovation without infringing on patents, even at this late day. For example, don't waste your time besieging the patent office with an electromagnetically-controlled tube. The idea of substituting the electrostatic control element, i.e., replacing the grid, with an external solenoid for controlling the electrons has long-ago come and gone. Indeed, if you are lucky, maybe such a tube will become part of your collection!

Likewise, the use of an external plate, that is a collector electrode mounted on the *outside* of the tube has also been tried—and, of course, found wanting. If you ever had any thoughts about room-temperature cathodes, your pursuits might lead to great rewards. However, be aware that a fairly good tube of this type was actually given serious consideration by the armed forces, and not too long ago. It seems that the inventor didn't ask himself how such a tube stacked up against the more reliable and more versatile solid-state devices.

However, if you are fascinated by tubes and your soul is responsive to the inventor's pulse beat, you might try to come up with the tube version of a PNP transistor. Of course, such an invention would have been far more timely before semiconductors upset the reign of King Tube. Nonetheless, there are still some tube applications and it still would be nice to have opposite-polarized tubes so that complementary-symmetry circuits could be devised. There would be other circuitry reasons which would make "PNP" tubes welcome. (All tubes ever constructed or marketed are analogous to NPN transistors becaue the plate is always *positive* relative to the filament or cathode.)

What you must do is to emit *positrons* instead of electrons and collect these with a negatively polarized plate. You have some advantages in your favor; the positron *has* been proven to exist. And it need only endure long enough to make the transit from its emitter to the plate. Inasmuch as it will be moving through a vacuum, maybe you can get enough lifetime out of it to do the job. Finally, you won't be belatedly competing with already-patented devices. Good luck!

Make Hay While Silicon is Here!

With mixed feelings of

nostalgic sadness and technological enthusiasm, hams, radio bugs, hobbyists, and experimenters have watched the encroachment of semiconductor devices on the sacred domain of tubes. Today, this usurper continues to relentlessly obsolete transmitting tubes of ever higher power and frequency. What can't be economically achieved in any single bipolar or FET output device is often readily implemented by various power-combining techniques. Although we have not yet heard of cherry-red collectors or incandescent drains, it must be conceded that rf power transistors are far from fragile if operated in intelligently-designed circuitry and if reasonable intelligence is manifested in tune-up and in operation.

Rather than bemoan the all-engulfing aspect of our solid-state era, take joy in the realization that the silicon revolution has been the tube *collector's* best friend. Tubes that once littered the landscape like beer bottles have become emotional gems and are priced accordingly. At this writing, the once mundane 99 peanut tube exchanges ownership for a non-peanut price—in the vicinity of twelve bucks. Its rival, the WD-12, commands fifty dollars if you are so lucky as to uncover one. And the asking price of the O1A, once a glut on the market, has recently been moving up, too. If you can still acquire any for four dollars, consider yourself lucky. More likely, you won't get back much change from a ten-buck bill! Other tubes have various worths, all depending on how much some other collector wants it. But, unlike diamonds, old-tube prices have been on a steady ascendancy. Maybe *now* would be a fruitful time to start your collection! ■

Give Your Disks a Physical

Are you getting what you pay for? Use this simple technique to quality-inspect your valuable floppies.

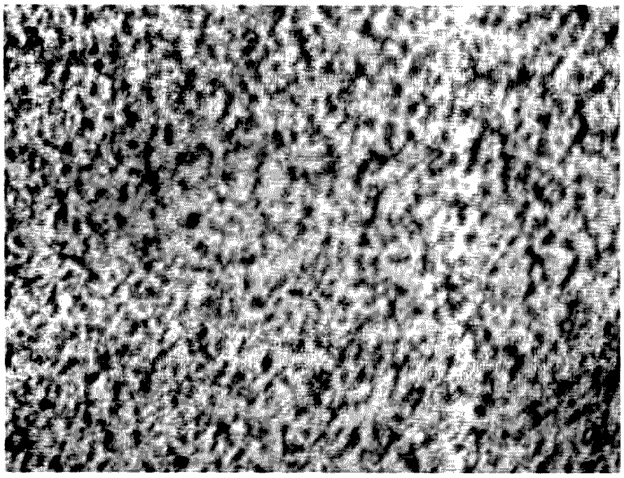
Kenneth S. Kraska
11 Yeager Drive
Cheektowaga NY 14225

I recently had difficulty with my computer's disk drive. Fortunately, it only required cleaning and some adjustment, and the work was covered by warranty. When I picked up my computer, I was asked about the floppies I used. It so happens that the brand I used was not sold by the dealer who had my disk drive fixed. Well, the suggestion was made that I was using the wrong disks and that the ones the dealer had were more appropriate. Over the next few days I grew more curious about which disks were truly better, and I decided to find out for myself since I have some lab facilities available to me.

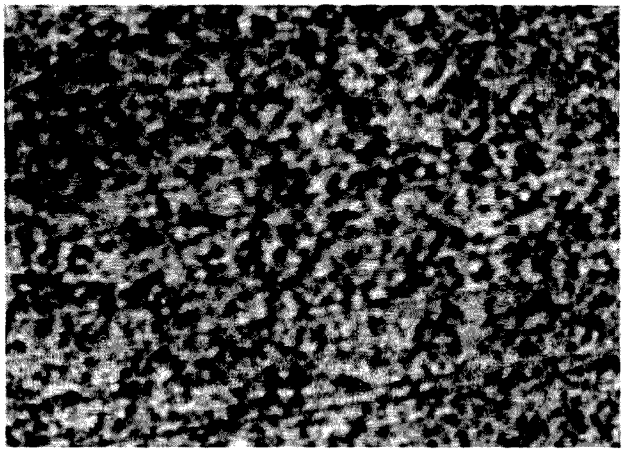
Background

My first thought was that since I knew very little about disks, I might want to know what standard they must comply with, that is, what sort of quality they must have. The American National Standards Institute (ANSI) has a standard for 5¼-inch floppy disks, known by the designation ANSI X3.82-80. On reviewing this standard, it became clear that this spec had only one quality level. No method existed for grading disks, one against another. Discussion with some technical people at a couple of large software publishers indicated that even within their industry there isn't one universal set of criteria for disk testing.

I decided that examination of disk surfaces by microscope might show details which would be relevant. The type of microscope used was an inverted-stage metallograph. It has a built-in light source, so that the light travels through the optical system to the surface being examined and is reflected back into the microscope to form the optical image. Also, because the floppy surface is so polished that it would produce considerable specular gloss (highlights and reflections), polarized light was used to unmask details. Photos of the microscope images (photomicrographs or "micros") were taken at various magnifications from 100× to 1000×. I examined a number of brands of unformatted disks right out of the package, as well as disks with programs on them (commercially available) such as word-processing or statistics programs. In an effort to get information on some of the physical properties, I measured the surface resistivity of the various disks. The ANSI standard specifies a maximum for this property (5 × 10^9 Ohms/



Plane polarized light at 100× magnification. A well-polished disk with good oxide distribution.



Plane polarized light at 100× magnification. This disk has many scratches and some ripples. Note the less even distribution of oxides.

square), and I felt that it would be an indicator of the relative read/write capabilities of a disk. After all, Ohm's Law should still determine the signal strength based on the conductivity (although this is a simplification and other factors should be considered).

Results

The resulting survey showed significant differences in both surface-finish quality and the (coated) oxide distribution. Further, the surface resistivity of disks varies greatly between brands (and even from one side to another on some disks). It turns out that my word-processing disk had just about the worst surface of any of the disks (maybe that's why the drive goes "grunge, grunge, grunge" when I use that disk!). The disks with the best surface finish and most uniform distribution had resistivities around 1×10^9 Ohms/square. Disks which were scratched, rippled, or nonuniform either had surface resistivities of around 1×10^6 or very high resistivities of about 4×10^9 Ohms/square.

By the way, the designation Ohms/square is the unit in the ANSI standard. The ANSI standard for disks references an ASTM (American Society for Testing and Materials) specification for surface-resistivity test method, known by the designation ASTM D257-78 (re-approved 1983), "Standard Test Methods for DC Resistance or Conductance of Insulating Materials." It seems that surface resistivity can be considered physically equal to the resistance (Ohms) measured over a gauge length of one inch. My word-processing program disk had a surface resistivity of about 690,000 Ohms/square. I guess it has to be so conductive to make up for the extraordinarily uneven surface (otherwise the signal from the track might be too weak to read). Also, the oxide particles aren't very uniformly sized.

I've included photomicrographs of two disks and I'm sure that it's easy to see why some disks are noisier (and more troublesome) than others. The disks which are visually the best are the ones producing the least trouble (for myself and some others I spoke with). On the other hand, the disks looking rather like a grating, or a washboard, are those which have caused some trouble (i.e., excessive noise, won't format, *won't* run).

Inspecting for Quality

I would suggest that to examine your own disks it is adequate to have a 50× magnifier. These are obtained without much difficulty or expense, and the level of magnification is minimally suitable to reveal the disk surface. Also, measuring surface resistivity is done easily. Use a digital multimeter (which has a range of a couple of megohms). Rig a parallel resistor (at least one megohm) to the contacts going to the disk surface. Using the rule for parallel resistances will provide the resistance, and therefore the resistivity, of the disk surface. Of course, a Wheatstone bridge may also be used. I was apprehensive of measuring surface resistivity of a disk which contained a program, because I wondered if some sectors might be damaged (good-bye, program!), but so far this has not happened. Be mindful of this possibility with disks containing programs.

If you examine a disk by the methods just mentioned, and very few if any scratches or ripples are found, and the resistivity is around 2×10^8 to 2×10^9 Ohms/square, then the disk should be OK.■

BARTER 'N' BUY

Individual (noncommercial) .... 25¢ per word
Commercial .... 60¢ per word

Prepayment by check or money order is required with your ad. No discounts or commissions are available. Please make your payment to *73*. Rates for multiple insertions are available on request.

Advertising must pertain to amateur radio products or services. No special layouts or positions are possible. All advertising copy must be submitted typewritten (double-spaced) and must include full name and address. Copy limited to 100 words, maximum. Count only words in text. Address, free.

73 cannot verify advertising claims and cannot be held responsible for claims made by the advertiser. Liability will be limited to making any necessary corrections in the next available issue.

Copy must be received in Peterborough by the 5th of the second month preceding the cover date.

Make checks payable to *73* Magazine and send to: Ross Kenyon, Advertising Department, *73* Magazine, 80 Pine Street, Peterborough NH 03458.

MOBILE IGNITION SHIELDING. Free literature. Estes Engineering, 930 Marine Drive, Port Angeles WA 98362. BNB006

MILITARY TECHNICAL MANUALS for old and obsolete equipment. 60-page catalog, $3.00. Military Technical Manual Service, 2266 Senasac Ave., Long Beach CA 90815. BNB045

QSLS to order. Variety of styles, colors, card stock. W4BPD QSLs, PO Drawer DX, Cordova SC 29039. BNB260

THE DX'ERS MAGAZINE. Up-to-date, informative, interesting. Compiled and edited by Gus Browning W4BPD, DXCC Honor Roll Certificate #4. Send for *free* sample and subscription information today. PO Drawer DX, Cordova SC 29039. BNB261

COCO OWNERS—Free software and hardware brochure. CoCoNuts, POB 9866, San Jose CA 95157-0866. BNB265

CASH PAID for traffic/speed radar equipment. Write or call: Brian R. Esterman, PO Box 8141, Northfield IL 60093; (312)-251-8901. BNB271

$$$$$ SUPER SAVINGS on electronic parts, components, supplies, and computer accessories. Free 40-page catalog for SASE. Get on our mailing list. BCD Electro, PO Box 830119, Richardson TX 75083; (214)-690-1102. BNB289

FIND OUT what else you can hear on your general-coverage transceiver or receiver. Join a shortwave radio listening club. Complete information on major North American clubs and sample newsletter, $1.00. Association of North American Radio Clubs, 1500 Bunbury Drive, Whittier CA 90601. BNB310

INDIVIDUAL PHOTOFACT FOLDERS: #1 to #1400, $3.00 postpaid. AJL, 414 Chestnut Lane, East Meadow NY 11554. BNB312

CX7 REPAIRS. Mark Mandelkern, 2315 Derby St., Berkeley CA 94705; (415)-549-9210. BNB320

IMRA—International Mission Radio Association. Forty countries, 800 members. Assists missionaries with equipment loaned, weekday net. 14.280 MHz, 2:00–3:00 pm Eastern. Brother Bernard Frey, 1 Pryer Manor Road, Larchmont NY 10538. BNB326

FREE: 100 QSLs with first order. Samples 50¢. Gazebo Press, Rt. 4 Box 4148, LaPlata MD 20646. BNB327

ELECTRON TUBES: receiving, transmitting, microwave...all types available. Large inventory means next-day shipment in most cases. Daily Electronics, PO Box 5029, Compton CA 90224; (213)-774-1255. BNB330

WANTED; radios, tubes, pre-1939 for my collection. Howard Stone, HCR-3, Box 418, Deer River MN 56636. BNB332

HAM TRADER YELLOW SHEETS, in our 24th year. Buy, swap, sell ham-radio gear. Published twice a month. Ads quickly circulate—no long wait for results. SASE for sample copy. $10.00 for one year (24 issues). PO Box 356, Wheaton IL 60189. BNB335

COMMODORE Authorized Service Center, 24-hr. service. WA2AJQ, 303 S. Vermont Ave., Royal Oak MI 48067; (313)-399-3990. BNB337

RADIO TRANSCRIPTION DISCS WANTED. Any size, speed. W7FIZ, Box 724—WG, Redmond WA 98073-0724. BNB347

CABLE CONVERTERS. Lowest price. Dealer inquiries accepted. Quantity discounts. Free catalog. P.G. Video Corp., 61 Gatchell St., Dept. 73, Buffalo NY 14212. BNB349

MOVING TO CENTRAL FLORIDA? Beautiful QTH, minutes from Disney World, 2,700 air-conditioned square feet, lovely half-acre wooded lot, prestigious neighborhood. Three bedrooms, two baths, fireplace, sophisticated ham shack, game room, screened porch, sun deck, separate matching 600-square-foot utility building (ideal for workshop or in-law suite). Furnishings possible. Includes 160' Rohn 45G construction tower, Wilson 5-element monobanders (10, 15, and 20 meters), inverted-V dipoles (40 and 80 meters), 13' Earth-station satellite system. Many other amenities. Superlative QTH for retiring radio amateur. $175,000, terms negotiable. For information, pictures, etc., call Don W4JTK, (305)-298-3116, or write (address OK in *Callbook*). (Moving to $300,000 home next door!) BNB355

NEW! CW WORD-COPYING COURSE Easy to learn. Complete. QSO-Trainer™ code course. Send $16.95 (Indiana add $0.85). Money-back, satisfaction guarantee (less $2.00 shipping and handling). Business-size SASE gets free information. AVC Innovations, Inc., Department 7C2, PO Box 20491, Indianapolis IN 46220-0491. BNB371

TRICK OR TREAT! No candy or apples but your unwanted equipment sure would be appreciated by the crew learning English through amateur radio at Junior High School 22 on Manhattan's Lower East Side. Send it today, feel better tomorrow, and get the tax advantage for 1985. Contact WB2JKJ. BNB372

SELLING: TS-830S, Morse keyboard, EV664 mike, Turner mike, Gentec dummy, Mosely beam. Box 623, Coventry RI 02816. BNB373

SATELLITE-TRACKING programs for the Commodore 64. Hi-res graphics program for antenna angles and ground track. $19.95 postpaid for disk and manual. Includes program for tracking two satellites in real time. David Eagle, 7952 W. Quarto Dr., Littleton CO 80123; (303)-972-4020. BNB374

LET THE WORLD KNOW what you would really rather be doing! Get your "I'd rather be DXing" bumper sticker with amateur radio written down the sides. Red and black, vinyl, and removable so it won't hurt your car. $2.00 plus 50¢ postage to: Bumper Sticker, PO Box 6349, Evansville IN 47712. BNB375

MOBILE PACKET RADIO—operate your TAPR or Heath TNC *from 11–14 V dc for* emergency or mobile operation. No TNC modifications required! Info for an SASE or complete kit $20.00. Gary Field WA1GRC, 5 Pluff Ave., N. Reading MA 01864. BNB376

WANTED: Regency XL2000, 10-channel 148-162-MHz transceiver, or Wilson WH2510. Also 1702A EPROMs. PO Box 929, Blacksburg VA 24060-0929; (703)-382-4458. BNB377

HI-MOUND keying mechanisms now available! Finest and most extensive line of hand keys, mobile keys, and iambic paddles. Write for free catalog. Skywave Radio Systems, Box Q-1, 943 Boblett, Blaine WA 98230. BNB378

WANTED: Kenwood TR-7625. Royce N. Sawyer, 547 Boston Post Rd. #71, Marlborough MA 01752. BNB379

TR-7 USERS—NB-7 noise blanker, new, $65 ppd. SL-300 CW filter, new, $50 ppd. HS-75 headset by Drake, new, $14 ppd. Tony Musero K3UKW, (215)-271-8898. BNB380

BURGLAR ALARMS...booming business. Get in now. Business/residential systems easily learned. Starting information $2.00. Dynamic Security, PO Box 1456-GH, Grand Rapids MI 49501. BNB381

NEW PATENTED ANTENNA invention design delivers 30 dB gain when compared to a dipole. Works on all bands, 160 through 10 meters, including the new WARC bands. Total parts cost under $10. For complete construction manual, send only $20 postpaid to: R. Christie, 215-28 Spencer Ave., Queens Village NY 11427. BNB382

CABLE TV CONVERTERS and equipment. Plans and parts. Build or buy. Free information. C & D Electronics, 626 Flowerdale, Dept. 73, Ferndale MI 48220. BNB383

QSL CARDS: 50/$5.00 or 100/$8.00, postpaid. For a sample send an SASE to Kenneth Hand WB2EUF, Box 708, East Hampton NY 11397. BNB384

SPECIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine by the first of the month, two months prior to the month in which the event

LOUISVILLE KY
OCT 4-6

The 1985 National ARRL Convention will be held on October 4-6, 1985, at the Kentucky Fair and Exposition Center (Exit 12 off of I-264), Louisville, Kentucky. Admission is $5.00 in advance and $6.00 at the door (12 and under are free). Features include a 200,000-square-foot indoor exhibitors' and flea-market area, ARRL forums, packet radio, AMSAT, FCC, National Weather Service, and alternate activities. For more information, contact the Greater Louisville Hamfest Association, PO Box 34444, Louisville KY 40232; (502)-368-6657.

TORRINGTON CT
OCT 5

The CQ Radio Club of Torrington will hold its annual flea market on Saturday, October 5, 1985, from 9:00 am to 3:00 pm, at the East Albert Street Recreation Building, Torrington CT. Admission is $1.00. Tailgating space is $5.00 and dealer tables are $7.00 each. Talk-in on 146.955. For more information, contact Donald Taylor KA1GKJ, PO Box 455, Watertown CT 06795.

SYRACUSE NY
OCT 5

The Radio Amateurs of Greater Syracuse are pleased to announce the 30th RAGS Hamfest to be held on Saturday, October 5, 1985, at the New York State Fairgrounds off Route 690, one mile east of Thruway Exit 39. Hours are 9:00 am to 6:00 pm, with flea-market setup beginning at 7:30 am. Rental for a large table in the indoor flea market is $6.00, and outdoor tailgating will cost $3.00. Features include VE exams (pre-registration required), an ARRL forum, and free parking. Admission is $3.00. Talk-in on 146.31/.91 and 147.90/.30. For further information, contact Viv Douglas WA2PUU or Ed Swatlowski WA2URK at PO Box 88, Liverpool NY 13088.

DEERFIELD NH
OCT 5

The Hosstraders will hold their annual fall tailgate swapfest on Saturday, October 5, 1985, at the Deerfield NH Fairgrounds. Admission is $2.00 per person, sellers included. Profits will benefit the Shriners' Boston Burn Center. Talk-in on 146.52 and 146.40/147.00. For further information, send an SASE to Norm Blake WA1IVB, RFD Box 57, West Baldwin ME 04091.

WARRINGTON PA
OCT 5-6

The Pack Rats of the Mt. Airy VHF ARC cordially invite all amateurs and friends to the 9th annual Mid-Atlantic VHF Conference on Saturday, October 5, 1985, at the Warrington Motor Lodge, Route 611, Warrington PA, and our 14th Pack Rat Hamarama on Sunday, October 6, 1985, at the Bucks County Drive-In Theater, Route 611, Warrington PA. Admission to the flea market is $5.00, with selling spaces $8.00 each. The gates will open at 6:00 am. Advance registration for the Conference is $4.00. For further information, write to Hamarama 85, PO Box 311, Southampton PA 18966, or call Lee A. Cohen K3MXM at (215)-635-4942.

YONKERS NY
OCT 6

The Yonkers Amateur Radio Club will sponsor its Electronics Fair and Giant Flea Market at the Yonkers Municipal Parking Garage, corner of Nepperhan Avenue and New Main Street, Yonkers NY, on Sunday, October 6, 1985, from 9:00 am to 4:00 pm, rain or shine. Admission will be $3.00 per person, with children under 12 free. For sellers, parking spaces will be $7.00; bring tables. There will be live demonstrations all day long, including amateur radio, computers, mini-theater, satellite TV, CB radio, etc., and a giant auction at 2:00 pm. There will be unlimited free coffee all day, plus free parking. For more information, call (914)-969-1053.

COLUMBIA MD
OCT 6

The Columbia Amateur Radio Association will hold its 9th annual hamfest at the Howard County Fairgrounds (15 miles west of Baltimore, just off I-70 on Route 144, 1 mile west of Route 32) on Sunday, October 6, 1985, from 8:00 am to 3:30 pm. Admission is $3.00 (spouses and children are free). Outdoor tailgating will be $5.00; tables $6.00. Fee for indoor tailgating will be $6.00 if received by September 30 and $8.00 after September 30. Food will be available. Talk-in on 147.735/.135 and 146.52. For table reservations or information, write Mike Vore W3CCV, 9098 Lampskin Lane, Columbia MD 21045; (301)-992-4953.

WEST LIBERTY IA
OCT 6

The Muscatine Amateur Radio Club and the Iowa City Amateur Radio Club will co-sponsor the Southeast Iowa Hamfest on Sunday, October 6, 1985. Doors open at 7:00 am at the West Liberty Fairgrounds in West Liberty IA. There is an indoor and outdoor flea market. ARRL/VEC exams will start at noon; pre-registration is suggested, as walk-ins will be accepted on a space-available basis. Talk-in is on 146.25/.85 and 146.52. For further information, contact Tom Kramer KE0Y, 905 Leroy Street, Muscatine IA 52761; (319)-264-3259.

SPRINGFIELD OH
OCT 6

The Independent Radio Association of Springfield OH will hold the 1985 Springfield Hamfest and Computer Expo on Sunday, October 6, 1985, from 8:00 am to 4:00 pm, at the Clark County Fairgrounds in Springfield OH. Admission is $2.00 in advance, or $3.00 at the door. For further information, call Ric Walsh WD8MSJ at (513)-322-8263, or write the Independent Radio Association, PO Box 523, Springfield OH 45501.

ST. CHARLES MO
OCT 11-12

The St. Charles Missouri ARC will operate WB0HSI on Friday and Saturday, October 11 and 12, 1985, at Frontier Park, to commemorate Discover St. Charles Days and the Boy Scout 75th Anniversary Camporee. Operation will be on 7.235 and 14.235. Other bands will also be worked if open. A commemorative certificate will be available for an SASE sent to St. Charles ARC, PO Box 1429, St. Charles MO 63301.

ST. PETERSBURG FL
OCT 12-13

The Florida Gulf Coast Amateur Radio Council, Inc., will sponsor the 10th annual ARRL Suncoast Convention on Saturday and Sunday, October 12 and 13, 1985, at the National Guard Armory in St. Petersburg FL. There will be a QCWA luncheon on Saturday, a luau on Saturday night, and a ladies' luncheon on Sunday. A special feature will be a demonstration of packet radio. Amateur examinations will be given on Saturday morning. Tickets are $3.00 in advance and $4.00 at the door. Hotel rooms are $34.00. Make all requests for tickets and hotel rooms to FGCARC, 1556 56th Ave. N., St. Petersburg FL 33703.

CONDORDIA KS
OCT 12-13

The Kansas State ARRL and MARS convention will be held at Concordia KS on Saturday and Sunday, October 12-13, 1985, at the Cloud County Community College. On Saturday, October 12, the State MARS meeting registration will begin at 11:00 am. ARRL VEC examination registration will begin at 10:00 am. There will be exhibits, forums, and a banquet (limited seating). Banquet tickets are $9.50 each in advance. Registration is $3.00; there will be free flea-market tables. For more information and VEC exam registration, contact Wendell Wilson W0TQ, 717 2nd Avenue Box 462, Concordia KS 66901; (913)-243-2872.

PARAMUS NJ
OCT 13

The Bergen ARA will be holding a Swap and Sell on Sunday, October 13, 1985, from 8:00 am till 4:00 pm, at the Bergen Community College, 400 Paramus Rd., Paramus NJ. Bring your own tables. Amateur license examinations will be given. Admission for sellers is $5.00; for buyers, free. Talk-in on 147.79/.19 and 146.52. For more information, contact Jim Greer KK2U, 444 Berkshire Road, Ridgewood NJ 07450; (201)-445-2855, nights only.

LANSING MI
OCT 13

The Central Michigan Amateur Radio Club and the Lansing Civil Defense Repeater Association will sponsor Ham Fair

85 on Sunday, October 13, 1985, from 8:00 am to 3:00 pm, at the Michigan National Guard Armory, 2500 S. Washington Avenue, Lansing MI. Admission will be $3.00; tables will be $.75/foot. FCC examinations will be offered at 1:00 pm with registration for examinations by September 13. Talk-in frequencies are 145.390 and 146.940. Additional information and reservations can be arranged with Rowena Elrod KA8OBS, 111 Lancelot Place, Lansing MI 48906; (517)-482-9650.

LIMA OH
OCT 13

The Lima Hamfest will be held at the Allen County Fairgrounds, Lima OH, on Sunday, October 13, 1985. Directions: one mile east of I-75, Exit 125A, on Route 309 and Route 117. Advance tickets are $3.00; $3.50 at the door. Tables are $6.00; half tables $3.50. For reservations, send an SASE and check to NOARC, PO Box 211, Lima OH 45802. License exams will be given. For exam information, contact NC8F at the above address.

WAUKESHA WI
OCT 13

The Kettle Moraine RAC will sponsor its annual ham/computer/video fest at the Waukesha Expo Center, Highways F & FT, Waukesha WI, on October 13, 1985. Tickets are $2.50 in advance and $3.00 at the door. Tables are $3.00 for each 4 feet of length. All facilities are indoors, so the event will be held rain or shine, beginning at 8:00 am. For reservations, send a check payable to KMRA Club to Kettle Moraine RAC, PO Box 411, Waukesha WI 53187.

SUNBELT AG EXPO
OCT 15-17

The Colquitt County Ham Radio Society will operate club station WD4KOW from the site of the eighth annual Sunbelt Agricultural Exposition on Tuesday through Thursday, October 15-17, 1985, from 9:00 am to 5:00 pm daily. The Sunbelt Expo is held each year at Spence Field Air Base, located near Moultrie GA, and is the largest agricultural show in the south. Operations are in the General portion of the HF bands. Members will also be listening for visiting hams on 146.19/.79. A special QSL card is available. Send an SASE to PO Box 813, Moultrie GA 31776.

CHELSEA MA
OCT 16

The Chelsea Civil Defense Office is sponsoring classes beginning on October 16, 1985, for those interested in obtaining a Novice, Technician, or General amateur-radio license. Both electronic theory and Morse code will be taught. There is a small charge covering the cost of materials. For more information, contact Frank Masucci, 136 Grove Street, Chelsea MA 02150. Please include your telephone number.

GRAY TN
OCT 19

The Johnson City and Kingsport Amateur Radio Clubs are sponsoring their Fifth Annual Tri-Cities Hamfest on Saturday, October 19, 1985, at the Appalachian Fairgrounds, Gray TN, located five miles south of I-81 on Highway 23. Features will include a flea market, forums, dealers,

SATELLITES

USING THE AO-10 APOGEE PREDICTIONS

Apogee predictions for the month of October are provided for three sections of the United States: Washington DC at 39N 77W, Kansas at 39N 95W, and California at 38N 122W. Times are in UTC and apogee in this case is mean anomaly 128 rounded to the nearest whole hour. Use the chart as a guide in aiming your antenna, then fine-tune the azimuth and elevation values to peak the satellite's beacon signal. If you require more accurate orbital predictions, contact AMSAT at PO Box 27, Washington DC 20044.

			WASH		KANSAS		CALIF	
ORBIT	DAY	TIME	AZ	EL	AZ	EL	AZ	EL
2060	1	0400	193	23	173	24	154	16
2062	2	0300	180	25	160	22	135	11
2064	3	0300	174	22	155	18	131	6
2066	4	0200	162	21	144	15	123	0
2068	5	0200	157	18	140	10		
2070	6	0100	146	14	131	5		
2072	7	0000	136	9				
2074	7	2300	127	4				
2079	10	1000					235	0
2081	11	0900					227	7
2083	12	0900					221	9
2085	13	0800			234	0	212	15
2087	14	0700			226	7	202	20
2089	15	0600	232	3	217	13	191	23
2091	16	0600	226	5	211	14	184	22
2093	17	0500	218	12	201	19	172	23
2095	18	0400	208	17	190	22	160	21
2097	19	0400	202	18	183	21	155	17
2099	20	0300	191	21	171	21	145	14
2101	21	0200	179	22	160	20	135	9
2103	22	0200	173	20	155	16	132	4
2105	23	0100	161	19	144	12		
2107	24	0000	150	16	135	7		
2109	24	2300	140	12	126	1		
2111	25	2300	136	7				
2113	26	2200	128	1				
2118	29	0800					230	4
2120	30	0800					225	6
2122	31	0700					216	13

and RV hookups. Talk-in is on 146.37/.97 and 147.87/.27. For further information, write Tri-Cities Hamfest, PO Box 3682 CRS, Johnson City TN 37601.

OPELIKA/AUBURN AL
OCT 19

The Society for the Promotion of Amateur Radio Communications will sponsor its first annual swap meet and packet exhibit at the Lee County Fairgrounds on US 431 just north of the US 29 junction, from 10:00 am to 5:00 pm. Space is $5.00 per vehicle in advance, $7.00 at the gate. Admission is $1.00. There is free parking, and refreshments are available. Talk-in on 147.06/.66. To make reservations, contact Ray Dodge, PO Box 2423, Opelika AL 36803-2423; (205)-745-2838.

MANCHACA TX
OCT 19

The Austin Amateur Radio Club will sponsor its fall swapfest on Saturday, October 19, 1985, from 8:00 am to 1:00 pm, at the Manchaca Fire Hall, Manchaca TX (located on Farm Road 1626, west of IH-35). Admission is free. A limited number of indoor tables will be available for $2.00 each. Refreshments will be available. Dealers are welcome. Talk-in on 146.19/.79 or 146.34/.94. For more information, please contact Jim Strohm KA5UXC, 1743 Cricket Hollow Drive, Austin TX 78758; (512)-837-5423 or (512)-837-4352. Send an SASE for a map.

BAR-B-QSL
OCT 26

The Healing Springs Mountain VHF Society, Inc., will operate special-event station WD4BBO at the second annual Lexington (NC) Barbecue Festival on October 26, 1985, from 1300 UTC to 2100 UTC, on 40, 20, and 15 meters. Phone activity will be 25 kHz up from edge of the General-class bands. Novice activity will be on 7125 kHz, as time permits. Also area 2m repeaters. For a special Bar-B-QSL, send an SASE to Healing Springs Mountain VHF Society, Inc., PO Box 41, Lexington NC 27293-0041.

POQUONOCK CT
OCT 26

The Tri-City Amateur Radio Club will sponsor its third annual auction on Saturday, October 26, 1985, at the St. James Parish Hall, Poquonock CT, 1-1/2 miles east of Route 12 on Route 2A (south of Norwich). Setup will begin at 9:00 am, and the auction will be from 10:00 am until everything is gone. Admission is free and there will be food available. Bring your equipment to be auctioned. Talk-in on 146.52 simplex. Call WA2RYV at (203)-464-6555 for further information, or contact Bob Dargel KA1BB, 8 Willow Lane, East Lyme CT 06333; (203)-739-8016 or (203)-446-7325.

CHATTANOOGA TN
OCT 26-27

The Seventh Annual Hamfest Chattanooga Amateur Radio and Computer Convention will be held on Saturday and Sunday, October 26-27, 1985, at the new Convention and Trade Center, Chattanooga TN. Admission is free. Eight-foot flea-market tables are available for $6.00 per day, or $10.00 for both days. Amateur licensing exams will be given. Talk-in on 146.19/.79. For further information, write Hamfest Chattanooga, PO Box 3377, Chattanooga TN 37404, or call Nita Morgan N4DON at (404)-820-2065.

LAKE TEXOMA OK
OCT 26-27

An introduction to amateur radio for the potential ham and Dutch-oven cooking for the traveling amateur are part of the special program features of Hamarama '85, held on Saturday and Sunday, October 26-27, 1985, at the Lake Texoma Lodge overlooking Catfish Bay, near Kingston OK. This ARRL-sanctioned hamfest will feature forums on severe weather and emergency operations, radio-club organization, traffic handling, and current FCC and ARRL matters. A banquet will be held on Saturday night. For further information, contact the Texoma Hamarama Association, PO Box 610892, DFW Airport TX 75261.

DANIEL BOONE HOME
OCT 26-27

The St. Peters ARC will sponsor a special-event station from 1700 UTC October 26, 1985, to 1700 UTC October 27, 1985, at the Daniel Boone Home in Femme Osage Valley MO (St. Charles County) to commemorate where Boone spent the last two decades of his life. KB0J will operate on approximately 3.915, 7.240, 14.280, and 21.420 MHz. A coonskin cap will be given to the first operator making contact with KB6J on all four bands. Certificates are available for an SASE from Bob Goin KA0IKU, 3112 Powder Horn Trail, St. Charles MO 63301.

FRAMINGHAM MA
OCT 27

The Framingham Amateur Radio Association will sponsor its annual flea market and exams on Sunday, October 27, 1985, at the Framingham Civic League Building, 214 Concord Street (Rt.126), in downtown Framingham. The doors will open at 10:00 am. Admission will be $2.00. Tables will cost $10.00, which includes one free admission. Pre-registration is required for both tables and exams. Talk-in on 147.75/.15. To reserve tables, contact Jon Weiner K1VVC, 52 Overlook Drive, Framingham MA 01701; (617)-877-7166. To register for license exams, send a completed Form 610, a copy of your ham license, and a check for $4.00 payable to ARRL/VEC to FARA, PO Box 3005, Framingham MA 01701.

LANCASTER PA
OCT 27

The third annual Red Rose Computerfest will be held on Sunday, October 27, 1985, at the Guernsey Sales Pavilion, located on Route 30 east, Lancaster PA, at the intersection of Route 896. Admission is $3.00 per person; children under 14 are free when accompanied by a paying adult. Doors will open at 9:00 am. Features will include computers and electronic equipment, a large indoor exhibit area, tailgating, hardware, software, and computer supplies. For more information, write to Computerfest Committee, PO Box 5029, Lancaster PA 17601.

MARION OH
OCT 27

The Marion Amateur Radio Club will sponsor its 11th annual Heart of Ohio Ham Fiesta on Sunday, October 27, 1985, from 8:00 am to 4:00 pm, at the Marion County Fairgrounds Coliseum. Tickets are $3.00 in advance, or $4.00 at the door. Tables are $5.00. Talk-in on 146.52 or 147.90/.30. For further information, contact Ed Margraff KD8OC, 1989 Weiss Avenue, Marion OH 43302; (614)-382-2608.

KALAMAZOO MI
OCT 27

The third annual hamfest and electronics flea market will be held at the Kalamazoo County Fairgrounds, Kalamazoo MI, on Sunday, October 27, 1985, from 9:00 am to 4:00 pm, with dealer setup beginning at 8:30 am. Admission will be $2.00 per person in advance, and $2.50 at the door. 8-foot table spaces are available at a cost of $6.00 per space. For further information on admission and table reservations, contact Ken KA8RUA, 2825 Lake Street, Kalamazoo MI 49001. Ham license testing will begin at 10:00 am. Limited walk-ins will be possible. Address inquiries to ARRL-VEC, Al Nelson K8OQB, 10603 Cora Drive, Portage MI 49081; (616)-323-3812.

SELLERSVILLE PA
OCT 27

The RF Hill Amateur Radio Club will hold its ninth annual hamfest on Sunday, October 27, 1985, at the Pennsylvania National Guard Armory, Route 152, Sellersville PA. Doors open at 8:00 am. Tickets are $3.00, with accompanying non-ham spouses and children free. Indoor space is $8.00, and tailgating is $6.00 on a first-come, first-served space basis. Food and beverages are available. Talk-in station W3AI will operate on 144.71/145.31 (Almont), 146.28/.88 (Hilltown), and 146.52. Sellers should call Robert Garland WB3AIG at (215)-674-4800, Ext. 515 to reserve indoor space only.

WIA 75TH ANNIVERSARY

The Wireless Institute of Australia, the world's first radio society, will celebrate its 75th anniversary during 1985. The WIA 75 Award will be available during the period from March 1, 1985, to December 31, 1985. To qualify, amateurs (and SWLs) need to contact (log) 75 members of the WIA. A contact will be valid only if the WIA member's individual membership number is logged. No more than 30 WIA members may be logged in any one callsign area. Send a log extract of the 75 members contacted and $2.00 (Australian) to WIA 75 Award Manager, Wireless Institute of Australia, 412 Brunswick Street, Fitzroy 3065, Victoria, Australia.

from page 4

11. William Hord W4WIJ, Florida
12. E. R. Nagy WA4CTY, Georgia
13. Wayne Carvalho KH6TZ, Hawaii
14. Donald Dunn W7GNU, Idaho
15. Daniel Noncek WB9FBO, Illinois
16. James Holicky WB9MAS, Indiana
17. Patrick McPherson WD9HTJ, Iowa
18. Robert Duncan N0EJF, Kansas
19. Charles McGinty WD4DLA, Kentucky
20. Greg Bain KA5QPI, Louisiana
21. William Condon KA1AZN, Maine
22. A. P. Fagan, Maryland
23. Bill Ross N1AZL, Massachusetts
24. Dr. Arnold Podolsky KR8S, Michigan
25. E. R. Van de Loo KA0DBO, Minnesota
26. Bill Boyer, Mississippi
27. Ed Bestmann WA0GEU, Missouri
28. Francis Shepard W7HAH, Montana
29. Willis Bengston WD0DXA, Nebraska
30. Gustave Lundquist, Nevada
31. Stuart Cowan W2LX, New Hampshire
32. Clark Magness N2EEY, New Jersey
33. M. L. Levy, New Mexico
34. Timothy Constable, New York
35. Carl Crumley N4VD, North Carolina
36. Donald Schroeder K0FUP, North Dakota
37. Guy Weaver, Ohio
38. H. B. Wortham N5BW, Oklahoma
39. Michael Heltborg WA7NPA, Oregon
40. Ralph Hartzell KC3KM, Pennsylvania
41. John Ambrose K1EW, Rhode Island
42. Lewis Cooke K4IQM, South Carolina
43. George Smith WD0BJH, South Dakota
44. E. L. Sanderlin W4RCE, Tennessee
45. E. V. Johnson, Texas
46. Jon Hunter K7JH, Utah
47. Charles Watson WA1NBU, Vermont
48. Charles Johnson KC4UQ, Virginia
49. G. F. Mitchelmore W3EYC, Washington
50. Sidney Jackson, West Virginia
51. Carl Woelfl, Jr. N9AAM, Wisconsin
52. Eugene Masserini, Wyoming

Each will get a complete set of 1986 *Callbooks* as soon as they're off the press (see "QRX").

Some Final Notes:

1. To KA5QPI—Please give my very 73 to old friend Mayor Jones. And let me know, please, if he doesn't do everything possible to help hams in Bossier City.
2. Make no mistake about it. Again, this issue is dedicated to Wayne Green W2NSD—"Never Say Die."

Jack Burnett

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

Well, for those of you who have been holding your breath for the last month, you can relax now; the wait is over. This month I shall begin to look at all the information all of you have sent me on the various ways to get this or that microcomputer onto RTTY. I will try to put whatever information I can lay my hands on into a unified whole each month, covering one computer per issue. If I write about your computer and don't mention your favorite RTTY program, it is not that I am being biased—it is because I have not heard of it! So—and manufacturers take note of this—watch for your computer type and feel free to comment on what I have to say. I guess I will have to break down and follow this series with an appendix of all the "forgotten" systems I left out. Then again, if I get the information—even late—it will still be a pleasure to print it. Enough of the prologue; let's push on!

The first machine I asked about (last January) was the Texas Instruments TI-99/4A. Although not many of these machines were sold initially, the deep discounts available when Texas Instruments closed out the model provided more than a few hams with their first taste of microcomputing. Because of the so-called "closed architecture" of the machine, however, there just is not an overwhelming supply of RTTY programming available for the TI-99/4A. Hmmm. Manufacturers of other "closed" systems would do well to take note!

Anyway, the name that kept coming up again and again was, of course, Kantronics. Their "Hamsoft" program seems to be about the only commercial program available for this computer. A formal review of Hamsoft was published in the April, 1983, issue of *73*, but let's see what some of you had to say about it.

Richard Dyer W5TCC and Art Lane WØDKN are two hams using the Hamsoft program with other vendors' interface units (more on that later). Art feels that the Hamsoft program performs "as advertised."

Mark Nelson AJ2X, another Hamsoft user, says that it "...seems pretty good, though I have cassette-loading problems for storing canned messages."

I presume you have cleaned and demagnetized your recorder heads, Mark. It seems that we often forget that cassette tape used on computers is only a little different than the stuff we use on the stereo. I mention that because I never cease to be amazed at the number of folks I hear who would not think twice about cleaning their audio-tape heads every few weeks, but never think even once about the computer cassette recorder they use many times a day. Just a thought.

Wayne Novack K3GBV, the Air Force MARS State Director for Maryland, notes that he is using the "Kantronics Interface and Hamsoft module for RTTY, CW, and to interface a Gemini-10X printer. All work well after you learn how to use them." Right!

I have a rather long letter here from William Maddock WAØAIZ, from Florissant, Missouri, detailing some of his experiences with the Hamsoft module for the TI-99/4A. In part, he writes, "I use the Kantronics software module. So far as I know, Kantronics is the only company to ever manufacture software for the TI-99. I would very much like to know, and I'm sure others would, too [know I would!], if anyone has come up with a decent program of any type, module, disc, or tape, which will even work with the TI."

Bill goes on to look at a comparison of the TI-99/4A Hamsoft with that for the VIC and C-64. Most notably, although the modules for the Commodore machines were less expensive, the TI-99/4A module included a parallel port, which apparently could be addressed through regular system calls. I won't get into a head-to-head here—we will be looking at other systems' available material as time goes by. (Hmmm...another song cue!)

And then there were the bits and pieces. For example, Jim Ketcham KA4AFI, from Ozark, Alabama, notes that he is using PTERM-99 and a modem but will be getting the Kantronics UTU (that's Universal Terminal Unit to those in the know) in a few months. How's it going, Jim? Let us all know what you think about this "computer-independent" piece of equipment.

Or Bill Davidson KW4J, in Birmingham, Alabama, who may be the only person in the country, for all I know, using (as he puts it) "a $15 program that...requires the Minimem module and is capable of both transmit and receive." Details, details! Where do these things come from? Are they for sale or do good friends just pass them around? I don't know—do you?

Now, I promised to say a little something about interfaces. You've read that some folks use the AEA CP-1 interface, some use the MFJ-1224 interface, and some are using one or another of the Kantronics interfaces. My gut feeling is that they are all good units. Look—you get, in this case, pretty much what you pay for. The more expensive units have features you may or may not want, at an additional price. Look over the specs and decide which one is right for you. If you want to home-brew, or use an older terminal unit with compatible outputs, that should be fine, too.

I was at a ham/computer get-together this past weekend and ran into a reader who related a story which warmed my heart. It seems that Larry Cisenfeld (not a ham but a friend of quite a few) was asked to help get some computers on the air. Trouble was, these systems were running under versions of CP/M, and the only programs he could find were on other CP/M systems, none of which were accessible. So he used an old 6800-program, published here many moons ago, to put a Smoke Signal Broadcasting 6800 system on-line, and used that to download the software. I believe he even translated the 6800 code itself for use on 6060 machines. Way to go, Larry!

Is there enough interest in Teletype Model 33s to devote a tutorial to the subject? I have been getting questions here and there on how to hook them up and have answered them directly. Please drop me a note and let me know if you would like to see more on this subject.

Regards to John Petrisin K2SSH, of Spring Lake, New Jersey. John is another CoCo user who is using this versatile machine on RTTY. I hope the one-chip terminal unit detailed here a few months back helps him get onto RTTY in an efficient manner. Let me know, John.

Hi to Sidney Smith KB1ST, up in New Canaan, Connecticut. Sidney is a new ham looking to get his Apple II+ onto RTTY. Well, in a little bit we will look at some of the programs your fellow hams have told me about for their Apple computers, but in the meantime I am happy to send you the list of "RTTY Loop" reprints you have asked for. Yes, folks, that list is still available, for a self-addressed, stamped envelope. It describes all the reprints I have put together to date, many of which are based on material printed in this column over the past eight or nine years, with suitable updating when necessary. Feel free to ask for your copy and add whatever comments you like as long as you are scribbling a request.

The electronic connection is still active, with more than a few hams receiving a prompt reply via CompuServe EasyPlex (E-Mail). If you have a question that can be answered that way, go ahead and address it to me via ppn 75036,2501. I'll try to reply as soon as I can, often right after reading the text of your question! Will wonders never cease?

Now, before I get all kinds of flack for mentioning all the wonderful equipment above and giving no way to get ahold of the manufacturers, here is a list of products and manufacturers mentioned in this month's exploration of RTTY equipment for the TI-99/4A microcomputer.

- *Hamsoft Communication Program*, Kantronics, 1202 E. 23rd Street, Lawrence KS 66046.
- *MJF-1224 Terminal Unit*, MFJ Enterprises, Inc., Box 494, Mississippi State MS 39762.
- *CP-1 Terminal Unit*, AEA, Inc., PO Box C-2160, Lynnwood WA 98036.

Now, I shouldn't have to remind you all of this since we have been through it so many times before, but if you contact any of these fine folk about their RTTY equipment, pleae tell them that it was in *73*'s "RTTY Loop" that you saw it mentioned, OK? You understand, it's not for me, but to allow the manufacturers to know where the amateur community gets its information, so that they might tailor the direction for their next product line. And, of course, where else to read about that new and exciting piece of RTTY gear? Right here, in "RTTY Loop!"

BE MY GUEST

Guest Editorial by Arthur Reis K9XI

THE NEW NOVICE

A year ago, no one would ever have thought it possible. Now, all of a sudden, it's two steps away from reality. The concept of the Novice license may be changing and with it, hopefully, the improvement of the chances for survival of the amateur-radio hobby.

You'll never find a better example of an idea for which the time has come. And it seems that a lot of hams realize it, too. With the ranks of the hobby dropping, the past year has seen a major turnaround on the collective attitude of the brethren, and with the release of RM-5038 by the ARRL on June 6, the other shoe has finally been dropped. Though the comment cutoff date for this Petition has long gone, look for it to resurface as an NPRM—and fairly soon.

So why even talk about such an issue? At this point, it may even be an apple-pie subject, right? No, and for two reasons. First, there is indeed a lot of opposition to RM-5038 within the hobby, especially among some 220-MHz operators. Some League members were upset that the Newington folks didn't consult them first. (Hogwash! Why duplicate the effort? That's what the FCC comments process is for.) Others were saying, "But not on *my* band!" That attitude doesn't even deserve to be dignified with a reply. (Another comment is, "Why bother? The hobby is dying anyway." Seriously, folks, I have heard that with my own ears, and on a Chicago area on-the-air forum held on this very subject!)

Second, there *are* some improvements which can be made to the ARRL's Novice Enhancement proposal, and they will be dealt with presently.

As one who some in the hobby refer to (mistakenly) as a mover and shaker of the 220-MHz band, I have been kept fairly well informed of the opinions of many of the present 220 users since RM-5038 came out, and I find that about 80 percent of them support the proposal. If this is true of the entire 220-MHz population, then it's a dramatic turnaround in just a little over a year. Why? It seems to be a combination of two things: one, a realization of the sniping that will always be happening against 220 until we get more activity on that band in all parts of the country, and two, what the Novice license is doing to amateur radio, and why.

We are now coming to the realization that the CW-only privilege is extraordinarily stifling to the Novice today. RM-5038 explained it very well when it referred to dead-band conditions on 10 and 15 meters, broadcast-station interference on 40, and interference from Canadian telephone on 80, especially during the evening hours at the time of the greatest Novice activity. But it goes beyond that. CW is at its best at traffic handling, contest work, DXing, and in some phases of emergency work.

However, *as an encouragement to upgrade*, especially by one's peers and role models, there is no way that CW at 5 to 15 wpm as practiced on the Novice bands can possibly cut it. I've heard of upgrade classes being held on VHF FM, but on 80-meter-Novice CW? No way! To learn, you have to communicate as fast as you can think, and in the interference-plagued environment of the Novice bands, a new ham is doing well just to communicate his callsign, name, OTH, and a signal report.

One friend of mine, active on 220 for many years, told the Chicago on-the-air forum, "In my three years as a Novice, I never *once* heard a bit of encouragement to upgrade aimed at myself or at anyone else on the bands." Without that peer/role model encouragement to upgrade, *on the air*, a Novice, more often that not, is a seed cast upon a rock.

The Novice license as presently structured effectively eliminates from the entry level of amateur radio the residents of apartment houses, condominiums, and townhouse developments. To ask a Novice, with limited operating and technical experience, to limit his power, his antennas, and even his operating hours because of where he lives, is inviting the exact kind of frustration which will send him straight to stamp collecting. That

means that we are losing a lot of good potential operators, especially those in urban areas, not to mention the young who have virtually no control over where they live.

Another ramification of the present Novice structure has an indirect bearing on the future of VHF/UHF operation. The Novice who survives the ordeal of the present privilege structure intact will, more often than not, be an operator predisposed to low-band DX-chasing. Only the most competitive survive, it seems, and there is almost nothing more competitive than the hunt for DX. To put it bluntly, it seems to a lot of us within the hobby that the present Novice-license structure has bred a generation of American DX musclemen which has done too little to enhance the cause of "international goodwill through amateur radio."

On the other hand, the desire to explore the frequencies outside of the low bands has been stunted by the selective weeding out of those who might be interested in modes other than low-band CW or phone DX-chasing and contesting, which has resulted in a decided lack of activity, per capita, on all bands above 15 meters except two meters. I would suggest that the changes proposed in RM-5038 and its hoped-for successor NPRM will go a long way toward correcting that inequity and as a by-product, will help us keep all the amateur VHF and UHF bands "all amateur."

Oh? Why, certainly! You must realize that 220 MHz is not the only amateur band in danger of being lost due to under-activity. We've already lost 420-430 MHz near Canada (for a number of reasons, really), 1215-1240 MHz, 2310-2390 MHz, and as the press for frequencies by the commercial interests moves upward, other VHF/UHF bands are or will become targets. To foster a love for all VHF work, not just 2-meter FM, you have to have a taste of that VHF experience early. So, why not Novice privileges on 220 MHz, 1250 MHz, or both? If we don't, we will soon be finding ourselves fighting the same sort of rear-guard actions that we've been fighting on 220 MHz for the rest of our amateur-radio lives. The thought is indeed depressing.

The present trend of emergency and public-service communications is away from low-band-CW work and toward the VHF hand-held radio. CW is used in times of real disasters as a liaison between the disaster area and the outside world, but the experience needed to handle that sort of traffic is often beyond the range of the typical Novice licensee. Thus Novices who are involved in emergency and public-service work may handle *off-the-air* chores, while it is *on the air* where they are most often needed, and it is from there that they are summarily excluded under the present circumstances. Not only is a mind a terrible thing to waste, but so is talent and so is a desire to serve when needed. All are wasted if a Novice cannot be used as needed in a communications emergency simply because of legal or political considerations.

I know of maybe a half-dozen people in my life who would be on the air three months from today if they could get there using their computers and not have to worry about anything else. I would suggest that many of them may even be willing to learn the Morse code if the Novice license would allow them to do more than just pound brass to an upgrade. And that's just the people I know. How about your circle of friends? Sound like a good potential for growth in the hobby?

Now, while a lot of Chicago area hams who participated in the On-Air Forum on the Novice-license proposal agreed that the time for Novice enhancement is right, there were some constructive criticisms heard as well, and in the main, I agree with them.

For one, the length and renewability of the Novice license should be reexamined in light of the ARRL proposal. Just as surely as enhanced Novice privileges will allow for more exposure to the wide variety of activities which make up the Amateur Service, and as surely as the Novice licensee will receive more assistance in his or her efforts to upgrade as a result, it is in the best interests of the hobby to provide yet one more incentive to upgrade: The Novice license should be good for a period of less than ten years and the license should be nonrenewable. Several hams who spoke in the On-Air Forum mentioned a license term of two years. I would suggest that that is *too* short. Four or five years sounds much more ideal to me. But nonrenewable? Yes. These are heady privileges being proposed here. Under the circumstances, a forever-Novice license is not really in the best interests of the hobby.

I also wonder about the wisdom of grandfathering present Novice license-holders into these new privileges, since under the terms of the Petition new Novices would have new questions covering the new privileges which were never asked of the older Novices. The problem with my feelings on this, however, is that in a practical sense, differentiating the old Novices from the new Novices would be an almost impossible task. Besides, the number of old Novices compared with the new may become vanishingly small anyway. Mind you, this comes from a writer whose wife and older son are both "old Novices." They won't even speak to me if they see this in print!

Another thing: If the Novice license is enhanced, this would be a good time to put Novice testing under the VEC program. With these new privileges in hand, the stakes on the Novice really knowing what he or she is doing will be even higher than ever. The VEC program has proven itself by now over most of the country to be a trustworthy one, and as such is superior to the present method of Novice testing. I suggest therefore that it is time to let the VECs do it all. Both they and the hobby deserve it.

As I said at the outset, RM-5038 will be dead for filing comments long before you read this. But you'd best believe that it will be back soon, at an NPRM near you. There are other ramifications of this Petition that I have not gone into here, so it's time to read up on it and decide. I know that this phrase is grossly overworked, but I'll say it again, and with a twist this time: The future of amateur VHF/UHF, and especially of 220 MHz, may well rest on what the FCC does with RM-5038 and with the NPRM which comes out of it. And what the FCC does with THAT will depend a lot on what you say *or what you DON'T say* to the FCC when the time to comment on this proposal again comes around.

Mr. Reis is the publisher of 220 Notes, The National 220-MHz Newsletter.

LETTERS

THANKS, DAVE

Congratulations to the *73* staff on completing 25 years of amateur-radio publishing. When *73* was founded, the first OSCAR satellite was just a dream. Now, the second manned operation from space is already history, complete with live color SSTV pictures! The next 25 years should be even more exciting. 73, and best wishes.

David Sumner K1ZZ
Executive Vice President
American Radio Relay League

HUZZAH 2

I read the guest editorial in the March, 1985, issue of *73* and thought that I would write to whole-heartedly commend and support you in your remarks. I have operated DX and semi-DX at club station VS9MB and at my home station GW4VBN, and most recently portable in 4X—I really know the frustration of wanting to have a rag-chew with someone when the QRM is at intolerable levels. I do not see why any of your suggestions would be impractical other than in the minds of the very people who are causing the situation.

Thanks, and let's wish for the demise of the "5NN NH 73" brigade.

Graham Sorenson GW4VBN/4X
Haifa, Israel

LAX HR IS...

Your idea of a Ham-Day was a good one that I hope was widely participated in by your readers.

On March 24, 1985, I invited 2 friends who are active in CB radio to my ham shack. When I sent out a CQ, a Japanese ham came back and my friends were very impressed by what ham radio could do with less than 100 Watts. A month ago I gave one of them a Novice test and he now has his ticket and is happily pounding the brass.

It was so easy and pleasurable to introduce others to this exciting hobby. I wonder why our ranks are shrinking when there are quite a few people out there who will get hooked like I did once they see what it is all about.

I soon realized that if every US ham would take the time to introduce others to hamming, we could double our ranks within a very short time.

If only these rag-chewing old-timers on SSB would talk about how many Novice tests they gave last month rather than what brand of laxative they use, this hobby would be a lot better off.

Michael Nowicki N6LUU
San Jose CA

DISPLAY REPLAY

Hurrah for Thomas Miller WA8YKN and his frequency display, "What You See Is Where You're At," in the July, 1985, *73*. This project was just what I was looking for. However, I am one of the sorry fellows with a backward vfo. As the dial is turned up, the vfo frequency goes down. I suggest using 74192 counters instead of the 74196 counters and counting down instead of counting up. I will be trying this idea on my Heathkit HW-101.

Carl Anderson WB0DFH
Minneapolis MN

This letter is prompted by an article in the July, 1985, issue of *73* entitled "What You See Is Where You're At." Unfortunately, it isn't.

The single-input display described will not be accurate on any ham-radio transceiver, not even the Ten-Tec Argonaut, because the bfo changes frequency when using CW and the opposite sideband position of the mode switch. This will put the display out by approximately 750 Hz in CW and 3 kHz in the opposite sideband position. In fact, the display may not even be accurate in the normal SSB position because Ten-Tec uses a different procedure than most to set its bfo crystals—they position the bfo on the skirt of the crystal filter by voltage, not by frequency.

The readout scheme described in the article works on only one well-known ham receiver, the Drake R-4. It will work because of the unique bandpass system the R-4 series uses. This is the only case where our digital display has only one input to count against a preset.

To display the frequency of Collins S-line, FT-101 (all), TS-520, TS-900, R-599, HW-101, SB-102, and all similar types, you must count all three of the frequencies that make up the operating frequency (hfo, bfo, and vfo). There is no way around this.

For the Argonaut, Atlas 210X, Swan 700CX, and all of the other similar radios that use a premix system (vfo and hfo mixed for first mixer injection—Swan uses a vfo only for premix), you must count both the premix and the bfo. In some radios the bfo is added to the premix on some bands and subtracted on other bands. Swans 350 through 700 work this way.

The only possible use for the article's display is on an old AM-only receiver like the DX-160 shown, using three digits only. When we supply a display for an older superheterodyne receiver that is capable of SSB reception, it both counts the direct mix vfo and subtracts the bfo. When the bfo is off (AM reception), our unit recognizes this and puts the missing bfo frequency into its calculators for a full six-digit automatic readout on an old Hallicrafters.

Unfortunately, your article leads readers to believe that they can duplicate the circuit and get an accurate digital readout to 100 or even 10 Hz. I am already receiving comments from people inquiring and mentioning the article. They imply that if my unit costs too much, they can always build their own. I suggest that you run some type of follow-up article to let your readers know what type of radio this display will and will not work on.

Roger Grandbois VE7LB/W7
President, Grand Systems
Blaine WA

I've received quite a bit of interesting mail from readers who enjoyed reading my article on the simple digital frequency display (July, 1985). Today, however, I heard a discouraging word in the form of a copy of a letter sent to *73* by a Mr. Roger Grandbois. It seems that Mr. Grandbois is a manufacturer of digital frequency dis-

plays. Since his letter was so far from the spirit of my article, I thought I'd write and give you my reaction to his claims.

I'm sure that the display sold by Mr. Grandbois is a fine unit. It should be, since it costs nearly as much as my Argonaut. The fact is, however, that my display was just not designed to do the same job, because that job simply wasn't required. My display only needs to count the vfo because its job is to increase the *resolution* of the dial, which it does very well. Mr. Grandbois doesn't seem to realize the difference between resolution and accuracy. Resolution is, by definition, making details visible. By programming an offset equal to the fixed oscillators in a transceiver, my display will not correct for inaccurate alignment or error in these circuits. It was not intended to do so.

The Argonaut has a slide-rule dial and a knob skirt with little marks, each mark representing 1000 Hertz. The Argonaut, therefore, has 1000-Hertz resolution. Try this trick. Tune in an SSB station perfectly, then turn the audio gain all the way down. Spin the knob a few turns and then come back to the *exact frequency*. Turn up the audio and what do you hear? Donald Duck? With my simple digital display, I can return to within *ten Hertz* of that frequency. Every time. That is 10-Hertz resolution. The true accuracy of the display will depend on the accuracy of the frequencies generated within the transceiver and their agreement with the value programmed into the display. Please note that the little marks on the knob skirt didn't take these things into consideration, either!

If the inaccuracy due to changing sidebands bothers anyone, it's a simple matter to add a switch to select a different pre-load for the kHz digit when on USB. Anyone who understands the circuit well enough to consider building it will have no trouble with that.

Let me just say that I'm sure Mr. Grandbois has a nice product which will turn any rig into a lab-quality frequency standard. Anybody with the need for superior frequency measurement with the bucks to get it might consider it. They might also consider trading the old rig for a new PLL job, too. But for much less money and a few evenings of tinkering, my display will increase the *resolution* of the analog dial by *one hundred times*. That was its intended purpose, and it does it very well indeed.

I'm not out to deprive anyone of a market for his product. However, I don't feel that any ham should be forced to buy an expensive solution to a simple problem. Many of us can't afford to do so. I simply provided a low-cost alternative, simple enough to be of interest to a great many hams, and by the mail I've received, a lot of people appreciated it.

By the way, the DX-160 with the digital display works well with the Argonaut for split-frequency operation. On Armed Forces Day last May 18th, I worked many military operators with this setup using all modes, including RTTY (yes, all the stations read out exactly on the published frequencies!).

Thomas M. Miller WA8YKN
Mansfield OH

REVIEW

YAESU FT-780R

When Yaesu brought out the original FT-780R all-mode 430-440-MHz transceiver, it was among the first radios on the market which relied on a microprocessor for control. Yaesu used a 4-bit NMOS micro to control every function on the transceiver—from frequency synthesis to memory selection, mode selection, and frequency display. At the time of its introduction a couple of years ago, it was at the leading edge of the radio art.

And, while it isn't at the cutting edge of technology—other rigs have passed it by in terms of bells and whistles—it is still a very creditable rig which should make a good addition to anyone's shack, especially if that operator is interested in satellite work.

Don't think, though, that this rig is strictly limited to satellite work, because it isn't. It can be used for 70-cm weak-signal work such as CW or SSB, and in this role it performs very well (as a recent effort in a terrestrial VHF/UHF contest showed).

If I were to classify the FT-780R, I would have to call it a tank. After powering it up from a 13.8-V-dc supply, it performed flawlessly. All of its features were easy to use and the built-in CW sidetone was good. Even the vswr protection circuit received a workout when a catastrophic antenna failure knocked the vswr of my antenna system sky high. The diode detector correctly sensed the mismatch and the drive to the finals was cut. When the problem was corrected, everything worked beautifully.

Features and Specs

The FT-780R is a feature-packed rig, and while it may not have 32 memories and other bells and whistles, it has enough functions to keep any operator happy. For starters, the NMOS micro controls frequency synthesis in 10-Hz, 100-Hz, 1-kHz, 25-kHz, and 100-kHz steps. It features 1- and 10-Watt output, selectable at the press of a button. With 10 Watts of drive, the FT-780R should be able to serve as the exciter for any 70-cm amplifier on the market.

The FT-780R I tested was the A/B or 430-440-MHz model. Model X covers 440-450 MHz. As I tested this unit I found that the lower portion of this UHF band is very nice for long CW rag-chews, something which you really can't say about the low end of 80 or 40 meters these days.

The CW note was well-shaped, and thanks to the clarifier control I was able to easily zero-beat other stations. This rig will work with most electronic keyers, the keyer being attached via a miniature plug to a jack on the rear of the transceiver. The key jack for CW has a key-up voltage of 8 volts and a key-down current of 1 mA. Just above the key jack is the external speaker jack.

As I operated the transceiver, I found that it is very stable. Frequency stability is specified as 10 ppm. This translates to a rig which can be placed on a frequency and left there hour after hour, which is what I did several times. I could detect no discernible changes in frequency, even after the rig sat for more than 12 hours in a hot shack.

The FT-780R model A/B is an all-mode transceiver, capable of CW, sideband, and FM, although there's admittedly very little FM activity on this portion of the band. Because of this I monitored my own tests using a scanner. My observations confirm that the audio is strong with an emphasis on mid-range frequencies. The high and low frequencies are rolled off fairly well. The audio is punchy and crisp.

In operation, carrier suppression is better than 40 dB down and unwanted sideband suppression in SSB operation is better than 40 dB. Spurious emissions are at least 60 dB down and frequency response is 400 to 2600 Hz at −6 dB. FM deviation is 5 kHz, although as I have noted, I only tested this feature briefly because I was more interested in using this rig for weak-signal work. Power consumption is 500 milliamps on receive and 4 Amps on high-power transmit.

The receiver has an SSB/CW sensitivity of 0.5 µV for a 20-dB S/N and a 12-dB Sinad of 0.35 µV on FM. Its FM sensitivity is 1 µV for an S/N of 35 dB. These sensitivity figures are quite respectable, although I suspect the serious UHF enthusiast will want to improve things with a good GaAsFET preamp mounted at the antenna. Selectivity for SSB/CW is 2.2 kHz at 6 dB down and 4.8 kHz at 60 dB down. FM selectivity is 14 kHz at 6 dB down and 25 kHz at 60 dB down. Image response is better than 60 dB.

One thing about the FT-780R is that it's not lightweight. Weighing 3 kilograms and measuring 60 × 180 × 250 mm, it is a fair-sized rig. You should realize these limitations if you are thinking of installing such a rig in a compact or subcompact car because you may not have the room for it. In a shack, though, its size isn't really a problem.

Operating

Overall, the Yaesu FT-780R is a pleasure to use. All of the key controls are either on momentary contact switches or standard push-buttons on the front panel. Other controls are on rotary switches.

For example, the FM squelch control is on a concentric rotary switch surrounding the on-off/volume control. The step control, which adjusts the frequency coverage per step (10 Hz to 100 kHz, depending on the mode), is next to the on-off/volume control. The step control is surrounded by the memory-selection rotary switch—up to four frequencies can be programmed in memory. Next to these controls is the main tuning knob, which is used to control the receive and transmit frequencies over the rig's coverage range. Next to the main tuning knob is the mode-selection switch for CW, LSB, USB, and FM. For those who opt for the model X, the mode switch offers the *standard* ±5-MHz *repeater* split, as well as simplex. An eight-pin connector is used for the microphone, a low-impedance unit which can also control band or memory scanning.

The top half of the front panel contains an LED bar-graph signal-strength indicator which doubles as a power-out indicator, as well as LEDs to indicate transmit, receive, clarifier engagement, and high or low power. Next to these indicators is the digital frequency display, which also indicates whether the rig is in memory or priority mode.

Interestingly, the FT-780R has dual vfos which allow split-frequency operation using vfos A and B. This allows you to work nonstandard repeater splits on the model X. Another interesting feature is the priority mode which allows scanning of the main dial and one memorized frequency every 7 seconds. This allows you to watch a frequency, such as the calling frequency of 432.100 MHz, while working or watching another frequency.

In operation, the clarifier, which actually functions as a superset of the frequency display, works well. Actually an RIT, it allows up to a 10-kHz offset from the received frequency and is very valuable in zeroing in on a station. The way the clarifier works is this: When you activate it, you begin at the frequency you were operating, which then changes as you turn the tuning dial. But if you deactivate the clarifier, you'll see that the transmit frequency remains the same. And reactivating it brings back the received frequency. The frequency display overlays and is a superset of the main transmit frequency.

As you would expect, the FT-780R is equipped with an N-type connector, which is far less lossy than the standard PL-259 with which we are all familiar. And while we're on the topic of connectors, the rear apron also contains a two-pronged power connector which mates with the power cable provided by Yaesu. Also on the rear panel near the massive heat sink is the memory backup switch. In the on position, dc power is supplied to the memory circuit and the frequencies that have been entered in memory will be retained.

On the bottom are two miniature connectors, one of which is for an optional 32-tone CTCSS encoder and the other of which supplies outputs for an external signal/power meter and a standby/control line for external amplifier control.

If you look at the bottom of the FT-780R, you'll see something different about it. It has a forward-facing speaker. Because it is angled in this manner, audio output is sent toward the front panel rather than into the floor or operating bench, which keeps the audio output from being swallowed by either a car's carpeting or your operating bench. In a car, this presents no problem because you can angle the mounting bracket to accommodate it. But in your shack, it means you must use the bail provided by Yaesu.

This bail, which kept slipping out on the model I reviewed, also provides protection for three important switches: scan selection, tone-burst activation, and satellite operation. The scan-selection and tone-burst switches provide rather obvious functions, but the satellite switch needs a fuller explanation.

When the satellite switch is activated, it allows you to shift your operating frequency while you are transmitting, much like the XIT control on an HF rig. This feature is particularly useful when in satellite operation because it allows the operator to zero in on the proper frequency within the satellite passband. However, it disables the clarifier and dual vfos when it is selected.

Overall, I found the FT-780R to be a good performer. It was easy to operate, and once I learned my way around the control panel—which didn't take long—it worked quite well. Its sensitivity seemed on a par with other 70-cm rigs on the market, and while I didn't have a GaAsFET preamp handy, I think it would even be hotter if you installed one at the antenna. CW operation was easy, as was SSB. The only limitation is the fact that I was unable to fully test the FM capabilities of this rig, although from monitoring myself during testing I can say that the audio was good with no sign of clipping.

This rig is a good choice for the satellite operator because of its capabilities as well as its ability to take into account the Doppler shift of satellite signals with the SAT switch. In fact, when it was offered, the FT-780R could be purchased with a console that fit a matching Yaesu 2-meter all-mode rig. This combination makes a superb satellite station.

As is the case with other Yaesu documentation, the instruction manual which came with the rig was complete and contained not only complete schematics of the rig, but also a good primer on theory of operation as well as service and troubleshooting hints. It's well worth the time spent reading it.

The Yaesu FT-780R was one of the first microprocessor-controlled, multimode UHF rigs on the market and it still represents a good value for the current price of about $500. For more information, contact *Yaesu Electronics Corporation, 6851 Walthall Way, Paramount CA 90723; (213)-633-4007.*

Marc Stern N1BLH
Framingham MA

WHAT DO *YOU* THINK?

Have you recently purchased a new product that has been reviewed in *73*? If you have, write and tell us what *you* think about it. *73* will publish your comments so you can share them with other hams, as part of our continuing effort to bring you the best in new product information and reviews. Send your thoughts to Review Editor, *73 Magazine*, Peterborough NH 03458.

KANTRONICS PACKET COMMUNICATOR

You can tell that an idea is becoming popular when the number of products available starts to increase. For well over a year, *73* has been telling you about the latest developments in packet-radio technology. Until quite recently, your choice of a packet-radio controller was somewhat limited. That is beginning to change.

The people at Kantronics have been cranking out some very fine software and hardware packages for radioteletype, CW, and AMTOR for several years, and I wondered when they would join the move toward packet radio. The wait is now over with the introduction of the Packet Communicator.

The first thing I noticed was the styling of the Packet Communicator. It looks like a telephone modem! It's the same style cabinet used by Kantronics for their UTU (Universal Terminal Unit), very low profile and sleek. Operationally it accepts the same commands as other TAPR-type units—welcome news for those of us already used to a particular command structure. Not all packet units can make this claim. The GLB board, for example, has a language all its own.

The Kantronics unit is based on the original TAPR (Tucson Amateur Packet Radio) TNC (terminal node controller) circuitry. Like the AEA PKT-1 and the Heath HD-4040, the Packet Communicator is manufactured under license from TAPR. Significant changes have been incorporated into the unit, however, making it a unique entry.

Numerous changes have been made to the TAPR program. For example, the Calibrate command implements a special calibration procedure that requires another Kantronics unit in order to be of use. Gone are the TAPR-implemented calibration procedures. That might be considered a problem, except that I have found the

Kantronics unit to be more stable than other TNCs I have used. It therefore doesn't need the calibration routines. Still, I wish there was an easy way to check the calibration without another Kantronics TNC. Also missing are many of the debugging tools available in the other TAPR units. The Trace command has disappeared. For most applications this presents no problems. I use the Trace function on other units to determine the paths used by other stations. There doesn't appear to be a way to do this with the Kantronics unit.

It appears that Kantronics designed this unit to encourage packet *operation* rather than being as concerned about packet *experimentation*. You would not expect a telephone modem to provide you with tracing and debugging commands. You only expect solid, reliable operation. As a packet-radio modem or TNC, the Kantronics Packet Communicator delivers all that it promises.

Some hardware modifications are also implemented on the Kantronics TNC. Rather than using the Exar Corporation demodulator chip set, Kantronics chose to use a "modem on a chip" with some attendant advantages. With most TNCs, it is necessary to make hardware and software modifications to switch from standard Bell 202 specifications normally used on VHF and UHF to Bell 103 standards used for HF and OSCAR packet transmissions. With the Kantronics Packet Communicator, it's as simple as using the Bell command. Another function of the new chip allows an Equalize command to be implemented. Some radio filters do not pass the mark and tone signals at an equal level. A certain fixed degree of compensation can be switched in and out utilizing the Equalize command.

A final change to the TAPR design allows you to select with a single jumper either standard RS-232 voltages or TTL-compatible voltages for use with your computer. This is particularly useful for the many Commodore owners who do not have a true RS-232 port on their computer. Normally an adapter that can cost $50 or more is needed, but because of Kantronics' foresight, this need is eliminated. Like the AEA PKT-1, the Kantronics unit does operate off of 12 volts dc rather than 110 volts ac. And it does come with its own power supply—a nice touch these days!

I've had my unit in operation since the day I got back from the Dayton Hamvention and have found that it does an excellent job. There were a few software bugs in early ROMs (read only memories), so be sure you are getting the latest version. If somehow you do come up with an old one, I'm assured that you will receive the latest version simply by requesting it. Kantronics has done an excellent job in the past at keeping their customers happy.

Now is the time to join in on the fun and utility of packet radio. The Packet Communicator and a VHF FM radio are all you need to get in on the ground floor.

The Kantronics Packet Communicator retails for $219. Further information is available from *Kantronics, 1202 East 23rd Street, Lawrence KS 66046; (913)-842-7745.*

Jim Grubbs K9EI
Springfield IL

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

CALIFORNIA QSO PARTY
Starts: 1600 UTC October 5
Ends: 2159 UTC October 6

Sponsored by the Northern California Contest Club. Single-operator stations may operate only 24 hours of the contest period; off times must be clearly marked in the log and must be at least 15 minutes long. Multi-operator stations may operate the full 30 hours. Stations may be worked only once per band per mode. Mobile stations may be reworked as they change counties. All contacts must be simplex and all CW contacts must be made in the CW subbands.

EXCHANGE:

CA stations send QSO number and county. Others send QSO number and state, province, or ARRL country.

FREQUENCIES:

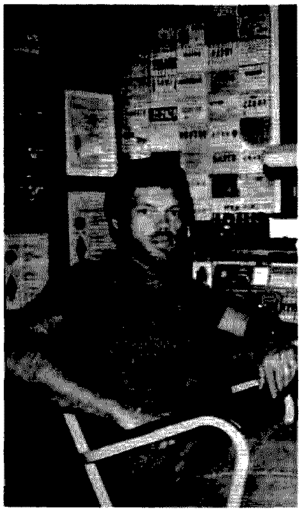
CW—1.805 and 50 kHz up from the low end of the bands. Phone—1.815, 3.850, 7.230, 14.250, and 28.500. Try CW on the half hour, 160 meters at 0500 UTC, and 75 meters at 0700 UTC.

SCORING:

Each completed phone contact is worth 2 QSO points. Each completed CW contact is worth 3 QSO points. For multipliers, CA stations use the number of states and Canadian call areas (58 possible). Others use the number of CA counties worked (58 possible). The final score is the number of QSO points multiplied by the total number of multipliers.

ENTRIES:

All logs and summary sheets must be sent by November 10 to: Alan Brubaker K6XO, 3675 El Grande Drive, San Jose CA 95132. Please include a business-size SASE with your entry for results and awards.



K4XS turned in an excessive score to capture the World Championship on 15 meters.

ILLINOIS QSO PARTY
Starts: 1800 UTC October 6
Ends: 0100 UTC October 7

Sponsored by RAMS, the Radio Amateur Megacycle Society, this year's contest has a new date, a new 7-hour length, and the addition of club/team competition. Additionally, IL stations can now work each other for county credit. Use all bands, CW and phone. The same station may be worked on each band and mode; IL mobiles may be reworked in each county. No repeater contacts are allowed.

EXCHANGE:

RS(T) and state, province, country, or IL county.

FREQUENCIES:

CW—3.550, 7.050, and 14.050. Phone—3.890, 7.290, and 14.290. Obviously, other bands may be used.

SCORING:

One point per phone QSO; 2 points per CW QSO. Illinois stations multiply QSO point total by the total number of states, IL counties, VE provinces, and a maximum of 5 DX countries worked. Additional DX contacts count for QSO points but not for additional multipliers. Illinois mobiles may add 200 to final score for each county of operation from which 10 or more contacts were made.

Non-Illinois stations multiply QSO points by the number of Illinois counties worked. Only Illinois stations may be counted for QSO points.

All stations may earn one extra multiplier for every 8 QSOs made with the same IL county.

AWARDS:

Certificates to the top 10 Illinois fixed stations; the top 5 Illinois mobile stations; the highest score in each state, province, and country; the highest club/team aggregate score.

ENTRIES:

Entrants shall submit a log containing times in UTC, call, RST, state or province, IL county, band, and mode. Circle new multipliers as worked. IL mobiles must indicate county changes in log. Any station with over 100 QSOs must submit a dupe sheet. All stations must submit a summary sheet. Entries must be postmarked by November 1 and addressed to: RAMS, c/o Joe LeKostaj WB9GOJ, 9134 Ewing Avenue, Evanston IL 60203.

RIO CW DX PARTY
Starts: 1500 UTC October 12
Ends: 1500 UTC October 13

Sponsored by the Pica-Pau Carioca (Rio Woodpeckers CW Group), PO Box 2673,

CALENDAR

Oct 5-6	ARRL QSO Party—CW
Oct 5-6	California QSO Party
Oct 6-7	Illinois QSO Party
Oct 12-13	Rio CW DX Contest
Oct 12-13	ARRL QSO Party—Phone
Oct 19-20	ARRL Simulated Emergency Test
Oct 19-20	Jamboree On The Air
Oct 19-20	Worked All Y2 Contest
Oct 19-21	Rhode Island QSO Party
Nov 2-3	ARRL Sweepstakes—CW
Nov 2-3	ARRL EME Competition—Part 1
Nov 16-17	ARRL Sweepstakes—Phone
Nov 23-24	ARRL EME Competition—Part 2
Dec 7-8	ARRL 160-Meter Contest
Dec 14-15	ARRL 10-Meter Contest
Dec 26-Jan 1	QRP Winter Sports—CW
Jan 11-12	Hunting Lions In The Air Contest
Jan 11	5th Annual 73 40-Meter World SSB Championship
Jan 12	5th Annual 73 75-Meter World SSB Championship
Jan 16	6th Annual 73 160-Meter World SSB Championship
Jan 25	2nd Annual 73 15-Meter World SSB Championship
Jan 26	2nd Annual 73 20-Meter World SSB Championship

the Honeywell
Radio Amateur

NEWSLETTER OF THE MONTH

The Honeywell Radio Amateur is not like most ham newsletters. For one thing, it's published only twice each year. It's also *big*. The latest issue has 64 pages! But what really sets the *Radio Amateur* apart from the crowd is the depth of its articles. Take a look at these titles: "Laplace Transform Primer," "The Search for Extra-Terrestrial Intelligence," and "Gulf Coast 220-MHz Link Experiments." These people are serious!

The *Radio Amateur* is edited by Mike Stapp KA0TQY and published by the Minneapolis Honeywell Amateur Radio Club.

To enter your club's newsletter in *73*'s Newsletter of the Month Contest, send it to *73*, 80 Pine Street, Peterborough NH 03458, Attn: Newsletter of the Month.

1985 RESULTS
20-METER WORLD SSB CHAMPIONSHIP CONTEST
Indicated are callsign, QTH, QSOs, States/Provinces worked, DX worked, and total score.
** World Champion * State, Provincial, or Country Champion

W/VE Single Operator

**NR5M	TX	1,690	59	51	1,082,950
*KA1GG	MA	924	50	65	814,775
W1BR	MA	904	54	58	775,040
*W5FO	TX	913	57	48	572,250
KA1XN	MA	563	48	59	441,375
*N7BES	WA	1,023	53	28	425,655
*K4XS	FL	436	46	29	296,825
*NI7T	OR	636	52	24	296,400
*WA6FGV	CA	782	57	7	268,800
*WB0WHB	KS	491	45	25	191,100
*VE1BDT	NS	330	41	44	164,900
*KV0I	NE	520	44	14	158,050
*N8CXX	MI	246	42	40	145,140
*W4WJJ	VA	342	37	22	117,410
WC4E	FL	323	53	13	113,190
*AC3T	DE	200	25	23	60,672
WT4G	FL	217	38	8	52,900
*AF1T	NH	238	33	8	50,840
*KD0HY	IA	151	31	17	41,520
K6AWW	CA	157	35	8	36,550
*W0IZV	CO	151	36	4	34,400
WB0YJT	KS	185	29	3	30,880
*N3AOE	MD	108	24	21	29,250
K1DII	CT	99	26	6	18,400
WD5GSL	TX	95	30	3	16,005
N0EKK	CO	105	11	6	15,725
K2SCU/5	TX	63	25	6	12,865
WE6G	CA	60	27	4	10,695
WK4F	FL	59	29	4	10,395
NE6I	CA	49	24	4	7,700
WA5IYX	TX	43	22	4	6,370
W3SOH	VT	39	17	6	5,175
KB4JSS	GA	44	20	2	5,060
W0NGB	MN	27	13	1	2,040
NE2W	NY	24	15	1	2,000
KR2K/1	ME	25	15	0	1,875
NN3SI	DC	19	12	2	1,470
KB0C/9	IN	20	9	3	1,380
KA9GHT	NH	15	10	0	750
VE3FEA	ONT	12	8	0	480
K5GN	TX	3	2	0	30
*KE7C	WA	1,171	55	29	559,860
*KA1YR	CT	501	46	54	360,500
*KD5RW	LA	411	46	13	133,045
*WB0OIZ	KS	343	39	14	96,460
*KB7M	WY	111	33	2	20,125

W/VE Multi-Operator

**K5LZO	TX	1,473	56	57	932,815

DX Single Operator

**OK1TN	Czech.	534	46	56	445,230
*LZ1YE	Bulgaria	358	36	67	272,480
*AH6FL	Hawaii	415	51	14	268,450
*EA6VO	Balearic Is.	433	41	29	222,950
*I4UFH	Italy	343	29	36	164,125
*JE4VVM	Japan	231	20	42	138,880
JA6BIF	Japan	137	16	21	50,320
*EA4BKE	Spain	145	25	21	49,450
VK2BQS	Australia	85	11	9	16,500
HR1FC	Honduras	86	27	2	15,225
JA2YDC	Japan	77	11	7	12,780
JR3BOT	Japan	57	9	12	11,550
SM7NJJ	Sweden	46	20	1	9,450
4U1UN	UN NY	60	15	1	4,680
GM4WEW	Scotland	30	9	11	4,600
JE1ARQ	Japan	27	11	2	3,510
OK2QX	Czech.	28	2	13	2,325
JA1ASO	Japan	17	12	0	2,040
JR1ZTT	Japan	14	11	0	1,540
CT1TM	Portugal	16	4	9	1,300
LZ1KKZ	Bulgaria	15	1	10	935
DL8AAM	Germany	3	0	3	45

DX Multi-Operator

**JA7YCQ	Japan	160	16	11	38,340

Multi-Op Participants

JA7YCQ	JR7MZC, H. Ikeda
KA1YR	KJ1D, K1WNT
K5LZO	K5LZO, KE5IV, NM5M, KA5SBS
KD5RW	KD5RW, ??????
KE7C	KE7C, WB7OJV
KB7M	KB7M, KB7WN

Check Logs: W3ARK, N4NW/ZS, LZ1L73 (SWL)

20001 Rio de Janeiro, RJ, Brazil—with the cooperation of all other Brazilian CW groups. The purpose is to promote 2-way CW contacts between Brazilian and DX stations, enabling DX stations to obtain QSLs valid for several Brazilian awards. The event is held twice each year on the last full weekend in March and the second full weekend in October.

The general call is "CQ RIO DX PTY." Use all HF amateur bands within your own station license authority. Exchange RST, name, and QTH. There are no logs, but quick QSLing (via bureau or direct) is essential.

Reference frequencies are as follows: 3.510/3.520, 7.020/7.030, 14.030/14.050, 21.030/21.050, 21.130/21.150, and 28.030/28.050.

JAMBOREE ON THE AIR
Starts: 0001 Local October 19
Ends: 2400 Local October 20

JOTA is the annual Scouting/ham-radio event held during the third weekend of October. This is the 28th year it has been held with thousands of stations around the globe participating. If propagation is right, it is common to work Scouting DXCC. In past JOTAs, Scouts in some remote areas like Antarctica, Ascension Island, Christmas Island, Gough, and Seychelles were heard.

In the USA, many Scout Councils and Districts hold camporees to coincide with JOTA—hams set up Field Day-type operations, giving campers a chance to exchange greetings with Scouts everywhere.

Generally, the exchanges include typical information like name, QTH, Scout rank, hobbies, etc., with some leading to long-lasting pen-pal friendships and the exchange of photos, badges, and patches. SSTV and ATV give some a chance to have a look at the other guy. Other QSOs reported were via RTTY, EME, and even OSCAR.

Look for K2BSA, the BSA Headquarters station in Dallas TX, and for HB9S, the World Scout Headquarters in Switzerland, and for other special callsigns from many countries.

Boy Scouts and Girl Scouts of all ages, Scouters, former members, ham-radio operators, or anyone interested in doing a good turn for Scouting and ham radio is invited to participate. The contest period is given in local time, though some activity flops over from Friday to Monday to take advantage of DX time differences.

Suggested frequencies are 3.590, 7.030, 14.070, 21.140, and 28.190 on CW; 3.940, 7.290, 14.290, 21.360, and 28.990 on voice; RTTY, SSTV, and ATV on usual frequencies. Check the Novice frequencies and please move off these calling frequencies to avoid QRM.

No reports in the form of logs are necessary—this is really not a contest. Exchanges should be relaxed and relate to Scouting and ham radio as much as possible. Brief reports, however, are appreciated giving Scout unit numbers, ham calls used and heard/worked, numbers of participants, interesting incidents and exchanges, etc. Photos with captions are especially welcome for the BSA report to the World Bureau. Send them to JOTA Coordinator, W2GND, 216 Maxwell Avenue, Hightstown NJ 08520.

Ham-radio amateurs are encouraged to invite Scouts or even Scout units to their shack. If you do not know any, contact your local Scout office for the name of the unit leader in your area. You or your radio club may volunteer to participate in a district or council camporee that weekend. Phone books list council offices as Boy Scouts of America. Call "CQ JAMBOREE" or respond to such calls and observe all FCC regulations. Consider a fox hunt for more fun.

If you are not a ham or do not have one in your unit, contact one in your area for help. If you need help finding one, contact Leo Kluger, American Radio Relay League, 225 Main Street, Newington CT 06111. Make reports as indicated above, coordinating with your ham helper.

Certificate cards, the size of a postcard, are available to anyone participating in any way. They may be ordered beforehand for presentation during JOTA, or they may be awarded at Scout or club meetings later. Send requests to: Jamboree On The Air, 1325 Walnut Hill Lane, Irving TX 75033-3096, along with a self-addressed, stamped envelope large enough to hold the cards ordered. Affix postage at 22 cents for the first 10 cards and 17 cents for each 10 cards thereafter.

A temporary insignia to wear on the Scout uniform or on a jacket is available at $1.50 each from the TX address above. Separate orders for certificates and patches will get them to you faster.

WORKED ALL Y2 CONTEST
Starts: 1500 UTC October 19
Ends: 1500 UTC October 20

The Radioclub of the German Democratic Republic (RKDDR) is pleased to invite radio amateurs all over the world to participate in commemorating the anniversary of the founding of the German Democratic Republic. Operating sections include single- or multi-operator stations as well as SWLs. Each Y2 station may be worked once per band on phone and once per band on CW.

EXCHANGE:

RS(T) plus serial number starting at 001. Y2 stations will send a two-digit number of "Kreiskenner" instead of a QSO number.

FREQUENCIES:

Use all amateur bands, 3.5 through 28 MHz, with the first 10 and last 25 kHz of the 3.5- and 14-MHz bands to remain contest-free.

SCORING:

Count 3 points per Y2 QSO. Multiplier is the sum of the number of different Y2 districts worked on each band (maximum 15 per band). The districts are indicated by the last letter of the call. Final score is the sum of QSO points multiplied by the total multiplier.

SWLs count 1 point on phone and 3 points on CW for each Y2 call with sent RS(T), 2-digit number, and call of station worked with the Y2.

AWARDS:

Certificates awarded to the leading stations in each section of each country.

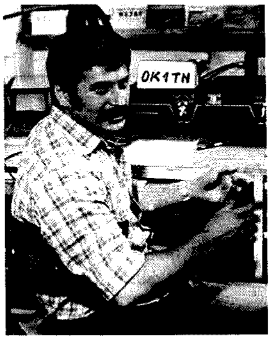
ENTRIES:

Separate logs are required for each band. Summary sheet showing multiplier and QSO worked on each band also required. Each log must be accompanied by the following signed and dated declaration: "I declare that my station was operated in accordance with the rules of the contest and in accordance with the requirements of my amateur-radio license." Logs should be mailed within 30 days following the contest to: Y2 Contest Bureau, RKDDR, Hosemannstrasse 14, DDR 1055 Berlin, German Democratic Republic. In the case of any dispute, the decision of the Y2 Contest Bureau shall be final. Applications for awards issued by the RKDDR fulfilled in the contest may be sent together with the contest log and indicated fee.

RHODE ISLAND QSO PARTY
1700 UTC October 19
to 0500 UTC October 20
1300 UTC October 20
to 0100 UTC October 21

Sponsored by the East Bay Amateur Wireless Association. RI stations work other RI stations and rest of the world. All

RESULTS



20m Single-Op DX Champion OK1TN. *EA6VQ reflects on his 20m victory.*

NR5M, K5LZO, AND OK1TN: 1985 WORLD 20-METER SSB CHAMPS

In its first year, the 20-meter SSB World Championship Contest encountered adverse band conditions in most parts of the world. That didn't stop NR5M, however. In less than 16 hours of operation, the 1985 World Champion averaged 105 Qs per hour, totaling 1,690 contacts! Just imagine what the score would have been like with improved propagation. Would we have seen nearly 3,000 Qs? Probably so. An unbelievable job!

From Czechoslovakia, popular contest station OK1TN took single-operator World Championship honors for DX stations. Despite poor propagation in and out of Europe, 534 contacts were made in 46 states and provinces with 56 DX multipliers.

Multi-op station K5LZO became the unchallenged World 20-Meter Champion for that operator class. Tallying 1,473 Qs, 56 states and provinces, and 57 DX countries, the station took a commanding lead with a total of 932,815 points.

Here are the stats for total QSOs:

20-Meter World QSO Records
Single Operator

1. NR5M	1985	1,690
2. N7BES	1985	1,023
3. KA1GG	1985	924
4. W5FO	1985	913
5. W1BR	1985	904
6. WA6FGV	1985	782
7. NI7T	1985	636
8. KA1XN	1985	563
9. OK1TN	1985	534
10. K4XS	1985	436

In the multi-op category, the QSO counts were not as plentiful. Only 6 entries were received, so the field of competition was not as great. This being the first year for the 20-meter event, a transition to the multi-operator category can be expected by many stations wishing to compete.

20-Meter World QSO Records
Multi-Operator

1. K5LZO	1985	1,473
2. KE7C	1985	1,171
3. KA1YR	1985	501
4. KD5RW	1985	411
5. WB0OIZ	1985	343
6. KB7M	1985	111

There are 61 possible US state (48) and Canadian provincial (13) multipliers. Stations working 50 or more in the contest included NR5M (59), KA1XN (57), WA6FGV (57), K5LZO (56), KE7C (55), W1BR (54), N7BES (53), WC4E (53), NI7T (52), AH6FL (51), and KA1GG (50).

If you were from the south-central or eastern states, your DX multiplier count could have been respectable. At least when compared to the West Coast. European stations were more plentiful than the 6s, 7s, and some 0s were able to claim. Stations with 40 or more countries included KA1GG (65), KA1XN (59), W1BR (58), K5LZO (57), KA1YR (54), NR5M (51), W5FO (48), VE1BDT (44), and N8CXX (40). For DX stations, only three contestants managed to work 40 or more DX countries: LZ1YE (67), OK1TN (56), and JE4VVM (42).

On 20 meters, it's not uncommon for most competitors to fill the skies with an aluminum overcast. Championship stations are no exception. When it comes to equipment and antennas, the trend is to have the biggest and the best. Let's review the top five stations in each operating class, and you'll see what I mean:

Single Op:

NR5M	TX	TS-930S	Alpha 77D	6-element KLMs at 75' and 145'
KA1GG	MA	TS-830	Home-brew 8877	4-element yagis at 80' and 120'
W1BR	MA	TS-930S	Alpha 78	
W5FO	TX	TS-930S	Collins 30S-1	4 els at 120', 3 els at 40'
OK1TN	CZ	Drake TR4C	Home-brew	6-element yagi at 72'

Multi-Op:

K5LZO	TX	TS-930S	Alpha 77D	6-el KLM at 120', 4 els at 50'
KE7C	WA	FT-101ZD	MLA-2500	Twin 5-element KLMs at 70'
KA1YR	CT	FT-102	Alpha 78	4-element yagi
KD5RW	LA	FT-901	Heath SB200	KLM tribander at 100'
WB0OIZ	MO	IC-730	Tempo 2001	Ground-mounted vertical

While we are analyzing the entries, let's see what contestants were using for antennas:

ANTENNAS USED (%) IN THE 20-METER TEST

24.6	4-element triband yagi
20.4	3-element triband yagi
20.1	6-element monoband yagi
9.4	Vertical
7.5	Inverted vee or dipole
4.0	5-element monoband yagi
2.7	4-element monoband yagi
2.3	3-element monoband yagi
1.8	2-element triband yagi
1.8	Wire beam
1.8	Delta loop
1.8	Log periodic
1.8	2-element quad

As we leave the summer season behind, I can't help but wonder if the longer daylight hours of summer wouldn't be a better time to hold this event and other high-band contests as well? Would we have to compete with other summertime activities (vacations, antenna projects, etc.)? I'm not sure how propagation would be affected by a change of season in 1987 but it certainly couldn't get any worse, could it? Should we keep the January contest dates as they are, or should we move the 15-, 20-, and proposed 10-meter events to the summertime when longer daytime hours prevail? If you have an opinion one way or the other, why not write me (KE7C) and share your thoughts.

In the meantime, I encourage every contester who follows this World Championship program to share his enthusiasm with his fellow hams. The contesting trend for these events is well established. When they first begin, there are those who sit on the sidelines and merely watch the activity. With increased competition, we see more and more well-known stations appear on the scene. Stations are able to work that much-needed state or earn another DX country contact. This contest is no exception.

For obvious reasons, the low-band contests are setting new world QSO records. Once the sunspot cycle reverses its trend, this 20-meter contest should become the leader among all the single-band events. Keep the faith and for gosh sakes, tell those DX stations you contact to join in on the competition! In most cases they'd be automatic award winners so long as they make a minimum of 100 Qs!

With the 1986 season quickly approaching, you are encouraged to obtain your contest rules and forms as soon as possible. This year we've made the process a lot simpler. When you request forms for a single-band event, you'll receive rules and forms for all of our World Championship SSB Contests. Send an SASE to *Contest Rules and Forms, Attn: Billy Maddox KA6JJK/3, 1162 Bayview Vista Drive, Annapolis MD 21401.*

As we conclude the 1985 season, it's only fitting that we thank our 20-meter contest chairman Chuck Ingram WA6R for all his efforts. In the background, I am sure, is his wife Linda KG6MO also in there pitching away. To this very dedicated husband-and-wife team we owe our gratitude. It may seem easy now, but stand by in the next few years! These are the growing years. The best is yet to come. See you in the January pileups!—*Bill Gosney KE7C.*

20-Meter Soapbox

VE1BDT	It was interesting working VK6IT at 1213 UTC while beaming over the north pole!
OK1TN	Good contest but poor conditions. I hope to see more stations on the band next year!
VK2BQS	It was an enjoyable contest.
W3SOH	Poor conditions. Had to rely on 5s, 6s, 7s, and 0s for most of my contacts. Hope there's more publicity next year. *(Ed. note: 6 months before the contest was held, announcements were mailed to every major radio magazine in the world. 1986 announcements have already been sent.)*
EA4BKE	I hope next year the conditions are better and that the XYL will let me do the contest!
JE4VVM	I enjoyed the contest.
I4UFH	Good contest but no good propagation.
W5FO	I think you may have a winner with this contest.
WD5GSL	Wasn't even planning on being in this one. Made 95 QSOs in the last 35 minutes of the contest.
WA5IYX	With low power and a vertical, it just isn't a viable place to be when its crowded.
KE7C	European DX is at a premium in the Pacific Northwest. East Coast stations nearly doubled our DX multipliers here. Can't work 'em if they're not heard! In 3-5 years, I expect this event to be among the most popular.
NI7T	I enjoyed the contest but we could have used a good European opening.

others work only RI stations. The same station may be worked twice on each band, once on phone and once on CW.

EXCHANGE:

RS(T) and state, province, country, or RI city.

FREQUENCIES:

Phone—1.850, 3.900, 7.260, 14.300, 21.360, 28.600, 50.110, 144.2, and 148.52. CW—1.810, 3.550, 3.710, 7.050, 7.110, 14.050, 21.050, 21.110, 28.050, and 28.110. Use FM simplex; no repeaters.

SCORING:

All stations score 2 points per phone QSO, 3 points per CW QSO, and 5 points for QSOs with Novices and Technicians. RI stations multiply QSO points by the number of states, provinces, and countries worked. Others multiply total QSO points by the number of different RI cities and towns worked (39 maximum).

AWARDS:

Certificates awarded to top-scoring station in each state, province, country, and RI county, plus top-scoring Novice and Technician in RI and out of state. There will also be a certificate for the top RI multi-op station.

ENTRIES:

Logs must show date/time in UTC, call, exchange, band, and mode. Include your name, call, mailing address, total QSO points, multipliers claimed, and final score. Entries must be postmarked no later than November 30, 1985, and addressed to: East Bay Amateur Wireless Association, PO Box 392, Warren RI 02885. Include an SASE for results.

1985 RESULTS
15-METER WORLD SSB CHAMPIONSHIP CONTEST
Indicated are callsign, OTH, QSOs, States/Provinces worked, DX worked, and total score.
** World Champion * State, Provincial, or Country Champion

W/VE Single Operator

**K4XS	FL	706	53	44	514,100
*KM5X	TX	583	47	50	379,755
*K4VX0 (KM9P)	IL	434	36	49	229,245
*K7QQ	WA	463	39	22	175,070
*WA6FGV	CA	511	45	7	151,840
*N8CXX	MI	268	36	31	102,510
KA6SWI	CA	263	39	7	70,380
*AC3T	DE	137	19	32	50,235
N8FEH	MI	192	25	16	40,795
*W9RE	IN	119	23	19	39,270
*W9XT	WI	148	23	17	32,600
*N4UH	NC	114	1	27	31,080
*KD0HY	IA	109	24	20	29,040
*VE1BDT	NS	117	22	14	22,680
WE6G	CA	63	22	6	10,220
WB0OIZ	MO	54	17	13	9,750
WA5IYX	TX	55	27	5	9,340
KC3AM	DE	47	19	12	9,300
WK4F	FL	47	21	10	8,990
K2SCU/5	TX	27	14	7	3,465
W0IZV	CO	29	15	4	3,135
KB4JSS	AL	34	8	7	2,700
KB7M	WY	40	12	1	2,665
W5EIJ	AR	24	7	6	1,755
W3SOH	VT	23	8	3	1,540
KB0C/9	IN	22	8	4	1,440
K8KUH	MI	18	8	5	1,235
WB2TKD	NY	12	7	3	800
W0NGB	MN	12	4	3	490
K5GN	TX	3	2	0	60

DX Single Operator

**VP9KA	Bermuda	306	36	13	71,530
*N4NW/ZS	South Africa	111	21	4	38,675
EA6VO	Balearic Is.	84	26	3	23,780
*LZ1KOZ	Bulgaria	132	0	27	18,900
*4U1UN (HB9RS)	UN NY	107	15	8	13,225
*JM1FHL	Japan	105	1	16	12,240
HR1FC	Honduras	72	23	8	11,160
I4CSP	Italy	30	14	8	6,490
CT1TM	Portugal	25	17	3	4,900
LZ1YE	Bulgaria	36	0	22	4,180
EC4BIR	Spain	21	4	12	2,320
HL1ABR	Korea	25	0	8	1,200
JH7EAY	Japan	35	3	3	1,200

W/VE Multi-Operator

**K5LZO	TX	759	51	45	457,960
*WD5GSL	TX	394	41	38	194,340
*KD5RW	LA	295	47	21	109,140
*KE7C	WA	206	30	13	57,405
*WC4E	FL	190	38	7	46,060

DX Multi-Operator

**JA3YBF	Japan	126	12	9	23,205
*JG1ZKO	Japan	106	10	17	22,545

Multi-Op Participants

WC4E	WC4E, AK4C
WD5GSL	WD5GSL, WB0TEV, WD5ABC
K5LZO	K5LZO, KE5IV, NM5M, KA5SBS
KD5RW	KD5RW, ??????
KE7C	KE7C, WB7OJV
JG1ZKO	JN1NDY, JM1HJG, JL1MWI, JQ1ITD
JA3YBF	JR4AGT, JA9TOZ

RESULTS

K4XS, K5LZO, VP9KA, AND JA3YBF 1985 WORLD 15-METER SSB CHAMPS

This 1st annual event was a true test of perseverance. The band was almost shut down entirely. Stations in Europe and Asia thought they had the contest dates wrong—they heard but a few stations on the band. Contrary to the outcome, there was in fact a contest held! The problem was, someone decided to invite Murphy to join in the fun. Seems like Murph was the only one succeeding—the propagation was lousy!

Leave it to the stations in the south-central and eastern states; they managed to work a bit of DX and accumulate a fairly respectable score. Of course, not as good as they could have had if old Sol had been on our side.

In the single-operator category, K4XS from Florida and VP9KA on Bermuda Island won the World Championship for W/VE and DX stations, respectively. K4XS had 706 Qs with 53 states and provinces, and 44 DX countries. VP9KA tallied 306 Qs, 36 states/provinces, and 13 countries.

In the multi-operator class, K5LZO took a commanding lead and JA3YF took DX honors to become World Champions in their respective divisions. From Texas, K5LZO and crew worked 759 stations, 51 states/provinces, and 45 DX countries. JA3YBF tallied 126 Qs, 12 states/provinces, and 9 DX countries.

Stations with 40 or more states/provinces were in the minority. They include: K4XS (53), K5LZO (51), KD5RW (47), KM5X (47), WA6FGV (45), and WD5GSL (41).

Working DX wasn't much better! Only 7 stations worked over 30 countries. Can you imagine that? It sounded like 10 meters! The fortunate few included: KM5X (50), K4VX/0 (49), K5LZO (45), K4XS (44), WD5GSL (38), AC3T (32), AND N8CXX (31).

The majority of participating stations didn't bother to turn in their scores. Most were convinced their scores were too low to win. Wrong! As the results show, most of those who took the time to turn in an entry managed to earn an award! Next year, keep that in mind.

Speaking of next year, mark down the 2nd Annual 15-meter Contest on your calendar. Be sure to tell all of your contest friends about it. If propagation is in our favor, 15 meters could surprise you with more DX than you could ever begin to realize in 1985! Remember, the 2nd Annual 15-Meter World SSB Championship Contest will be held 0000-2400 UTC on January 25, 1986. A 24-hour extravanganza that could surpass them all! Why not join us? 1986 contest rules and forms are now available. Send an SASE to the following address and you'll receive the rules and forms for all the World SSB Championship events: *1986 Contest Rules and Forms, Billy Maddox KA6JJK/3, 1162 Bayview Vista Drive, Annapolis MD 21401.*

Though all the aluminum in the world couldn't have helped, it still is interesting to survey the contestants to see the antennas they used. After analyzing the entries, here is what we found:

ANTENNA USED (%) IN THE 15-METER CONTEST

Tribander	41.0
4-element monobander	11.4
Vertical	11.4
6-element monobander	6.8
2-element quad	4.6
3-element monobander	4.6
5-element monobander	4.6
Inverted vee/dipole	4.6
Log periodic	2.2
6-element quad	2.2
Rhombic	2.2
Delta loop	2.2
Doublet	2.2

On 15, even with all of the firepower, big arrays, and full-power amplifiers, not even brute force could overcome the elements of Murphy's contest conditions. But as tradition has it, there is always next year.

On behalf of Gary Vest WA3KCY/5, our new 15-meter contest chairman, thank you one and all for giving this year's event your best effort. While it may have been frustrating to most of us, your contesting spirit is admirable, and your continued support makes the whole effort worth our while. Keep the faith—the sunspot cycle is like a yo-yo, now the only way is up! See you all again this coming January!—*Bill Gosney KE7C.*

15-Meter Soapbox

WD5GSL	Propagation? What propagation? Very lousy conditions this year. This event will top them all when the band comes back.
WA5IYX	Very slow Friday evening. Spotty all weekend.
KE7C	It may seem dead now, but look out in 3-4 years! The band will bust wide open. In the meantime...
EC4BIR	Not many USA stations. *(Ed. note: Don't feel bad, not much of anything anywhere. Stations were there but not the propagation, hi!)*
JM1FHL	Conditions to the USA very poor. *(Ed. note: Roger that, West Coast boys didn't get their JA strings either.)*
JR4AGT	Want more activity. Band very poor.
VP9KA	Thanks for the new contest. Lots of fun and I look forward to next year's event.
4UIUN	See you again next year. *73* Magazine, thank you!

HAM HELP

We are happy to provide Ham Help listings free, on a space-available basis. We are not happy when we have to take time from other duties to decipher cryptic notes scrawled illegibly on dog-eared postcards and odd-sized scraps of paper. Please type or print your request (neatly!), double spaced, on an 8½" x 11" sheet of paper and use upper- and lowercase letters where appropriate. Also, please make a "1" look like a "1," not an "l," which could be an "el" or an "eye," and so on. Hard as it may be to believe, we are not familiar with every piece of equipment manufactured on Earth for the last 50 years! Thanks for your cooperation.

I am compiling a list of biographies of radio engineers, inventors, and radio operators from the early days to the present time. Please send me the name of the book, the author's name, the publisher's name, the copyright date, and a brief description of the story. For an SASE I will send you a copy of the list.

W. Clem Small KR6A
26530 Parkside Drive
Hayward CA 94542

I need an RIT circuit for my NCX-3 transceiver and any other mods for this rig. I also need a schematic for the Heath VH-1 vfo. Thanks for your help.

Steve Jones KA7UAN
Box 865
Port Orford OR 97465

I need help from someone who is familiar with the Hallicrafters HT44 and its PS150-120 power supply. My supply puts out about 100 volts more than it should and the tubes and transistors are cooking! I'll pay the postage if somebody can help.

George Kitts
3807 North Garden
Roswell NM 88201

I am looking for a Kenwood TR-7625 2m transceiver.

Royce Sawyer N1BPU
547 Boston Post Road
Marlborough MA 01752

I need to buy a fold-over crank-up tower so that I can get my rotary antenna on the air. Any help?

George Stingel KM1W
649 Oakwood Drive
Glastonbury CT 06033
(203)-633-0334

I would like information on how to modify an ICOM IC-27H to receive signal outside of the normally 2-meter band.

Stanley Sines WA3QGA
15703 Bradford Drive
Laurel MD 20707

I have every issue of *73* Magazine from the first month to the present and would like to sell them for a reasonable price.

Joseph Strolin
21 Ellen Street
Norwalk CT 06851

I need information on how to increase the memory-scan rate of the Kenwood TW-4000A transceiver. Also, I'd like to know how to operate from 150-160 and 450-460 MHz without losing the normal 2m and 70-cm segments.

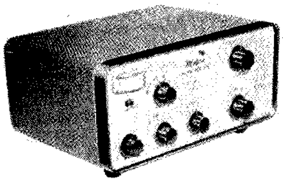
Charles Kelsey WB2EDV
RD #2 Box 63 Elmwood Ave.
Mayville NY 14757

NEW PRODUCTS

1962

WORLD SB-175

It is encouraging that World has been encouraged by the reaction of their DSB-100 to come out with a new double-side-band rig which covers all bands from 80 through 10 meters. This one, the SB-175, sells for under $100! It runs 100 Watts AM and 175 Watts CW. The cathode-grid block keying gives a nice clean CW signal. This small unit will be popular for mobile work, too, since it is small and doesn't require any difficult bias voltages. Send for info to *WRL, Council Bluffs, Iowa,* and mention that you read somewhere about it, you think.

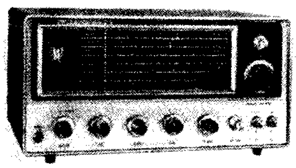


1962—World Radio Lab's DSB-100.

1966

LAFAYETTE HA-500 HAM RECEIVER

The new Lafayette HA-500 ham-band receiver tunes the 80- through 6-meter amateur bands in six tuning ranges. It's a 10-tube double-conversion superheterodyne. Among its features are tuned rf and first mixers, two mechanical filters, product detection, "always-on" oscillator filament, built-in 100-kHz calibrator, illuminated slide-rule dial, S-meter, automatically switched agc for AM or SSB, and less than 1-μV sensitivity. Size: 15" W × 7½" H × 10" D. Price is $149.95.

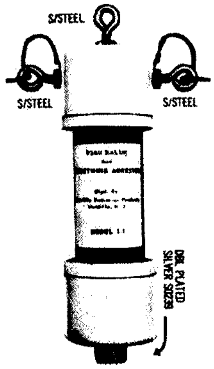


1966—Lafayette's new HA-500 receiver.

1970

HI-POWER BALUN

The *Big Signal* W2AU balun comes in either 1:1 or 4:1 conversion ratios, and boasts a full kilowatt (the California kind) capability, built-in lightning arrester, and a bandwidth of 3 to 40 MHz. Manufactured and distributed by Unadilla Radiation Products.



1970—The Big Signal W2AU balun.

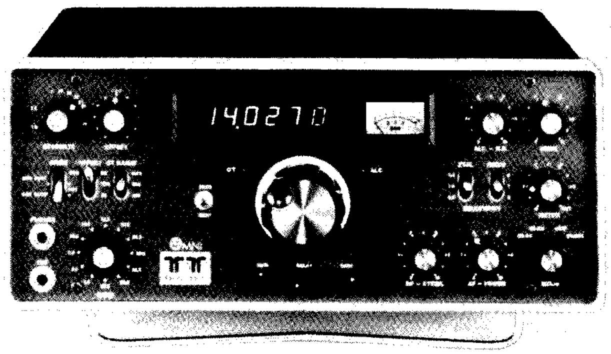
1975

VHF ENGINEERING CW ID KIT

A CW ID kit for commercial or amateur repeaters has just been announced by VHF Engineering of Binghamton, New York. The CW ID kit consists of high-grade components, drilled epoxy-glass circuit board, programming diodes, and can be built in approximately one evening by amateurs with nominal building experience.

This new CW ID from VHF Engineering presents a price breakthrough for the amateur. The kit price is $39.95, plus postage. Sufficient diodes are included to permit programming of virtually all repeater calls. Programming is accomplished in an easy manner by soldering diodes directly to the matrix board. Diodes are placed on the board in a straight-line fashion using three diodes for a dash, one diode for a dot, and no diodes for a space. Programmed calls may be changed at will merely by rearranging diodes on the board. Additional flexibility is provided since the unit may be programmed in either CW or RTTY code—thus this IDer may be used for automatic identification of any RTTY station.

The CW ID is also available wired and tested for $49.95, plus postage.



1980—Ten-Tec's Omni-C transceiver.

1980

TEN-TEC OFFERS NEW THIRD GENERATION OF THEIR POPULAR "OMNI" TRANSCEIVER

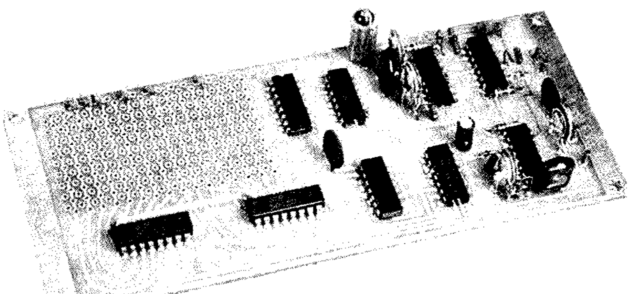
In addition to some interesting new performance features, Ten-Tec's new Omni Series C transceiver is one of the first amateur transceivers to have capability for all nine HF bands.

The Omni-C covers all amateur bands from 160 through 10 meters. Crystals are included for seven of the nine bands (crystals for the 18- and 24.5-MHz bands will be ready when the bands are).

Another unique new feature of the Omni-C is its three-mode, two-range offset tuning capability. It's the first to offer a choice of offset tuning for the receiver section, the transmitter section, or the combined transceiver. The three modes offer complete offset tuning flexibility for all needs, fine tuning interfering signals or chasing DX. The two ranges are ±500 Hz or ±4 kHz.

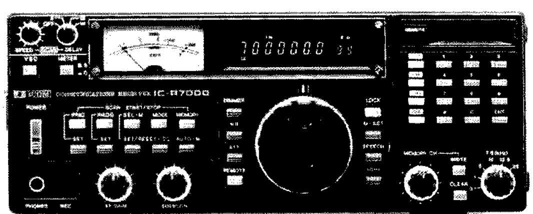
The Omni-C also offers new ease in using the seven response curves of its optimized bandwidth capability. New switching is provided for selecting the standard 2.4-kHz 8-pole SSB filter, the optional 1.8-kHz 8-pole SSB filter, the optional 250-Hz or 500-Hz 8-pole CW filters, cascading them for 16 poles of filtering or putting them in the signal path along with 450- and 150-Hz active audio filters.

New "hang" agc for smoother operation and a standard equipment noise-blanker (2-pole monolithic crystal filter) are other new features.



1975—VHF Engineering CW ID kit.

1985



ICOM's IC-R7000 receiver.

ICOM IC-R7000

ICOM has announced a new continuous-coverage receiver. The IC-R7000 will receive AM, FM, and SSB signals from 25–2000 MHz, including aircraft and marine communications, government agencies, emergency services, television, and of course amateur-radio VHF/UHF activity. Other features include 99 memory channels, direct keyboard entry of frequencies, several scanning modes with an adjustable scanning speed, narrow and wide filters, five tuning speeds, an optional infrared remote-control unit, and an optional voice synthesizer.

Complete information about the IC-R7000 is available from *ICOM America, Inc., 2380 116th Avenue NE, PO Box C-90029, Bellevue WA 98009-9029.*

CENTURION EAR COM

Centurion International, Inc., has acquired the Ear Com line of communications devices from Lear Siegler.

Ear Com is a miniature earpiece transducer that permits the wearer to send and receive voice messages through a radio set or intercom system in high-ambient-noise environments. The Ear Com permits hands-free communication, an important feature in hazardous occupations such as law enforcement, fire fighting, and industrial machinery operation. It can be used while wearing protective clothing such as a gas mask or a hearing protector.

Centurion's Ear Com communications system.

Novice study package by Radio School.

The complete Ear Com system consists of the earpiece, control module, and an interface cable which connects the control module to a radio or intercom unit. The Ear Com picks up voice signals through the user's otolaryngeal tract, amplifies and filters the signals, and sends them to the radio or intercom. Received messages are routed through the control module to the earpiece.

For more information about Ear Com, contact *Centurion International, Inc., PO Box 82846, Lincoln NE 68501, Attn: Sales Department; (800)-228-4563* or in Nebraska *(402)-467-4491.*

WINNER'S EDGE CONTEST SOFTWARE

Winner's Edge Software has announced The Contester, a fully-integrated program package for the amateur-radio contester. The Contester manages all of the contest paperwork, keeping track of up to 3,000 contacts on up to 6 bands, including a fast dupe-checking algorithm. The program will transmit pre-programmed messages and real-time text in 5-50-wpm Morse code.

The Contester is available for the Radio Shack Model 100, the Commodore 64, and the Commodore 128. For more information, write *Winner's Edge Software, 2003 Sarazen Place, Reston VA 22091.*

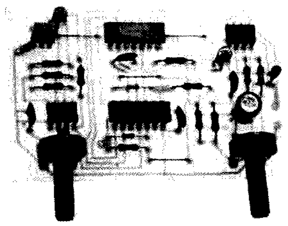
RADIO SCHOOL'S NOVICE STUDY PACKAGE

Gordon West at Radio School has put together a comprehensive study package for the prospective Novice. The material, collectively called "The Complete Novice," includes: four stereo code-learning cassettes in a vinyl holder, two Novice theory tapes in a holder, the ARRL's *Tune In the World* study book, the ARRL's *FCC Rule Book*, a brass telegraph key, a solid-state code-practice oscillator and battery, 200 Novice test questions, an FCC Form 610, a list of Volunteer Examiner Coordinators, a confidential written examination, and ten 5-wpm code tests.

Further information is available from *Radio School, Inc., 2414 College Drive, Costa Mesa CA 92626.*

BEL-TEK CMOS KEYER KIT

Bel-Tek has introduced an inexpensive keyer kit incorporating state-of-the-art circuitry and low-power CMOS digital integrated circuits. The keyer provides jamproof spacing and can be operated at any speed between 5 and 50 wpm. The built-in 800-Hz sidetone has an adjustable volume control. A high-voltage keying transistor reliably switches loads of up to 250 mA and is compatible with grid-block, cathode, and solid-state inputs.



Bel-Tek's CMOS keyer kit.

The CMOS keyer kit includes a 2.3" × 3.5" printed circuit board and all of the components necessary to build the unit.

For complete details, write *Bel-Tek, PO Box 125, Beloit WI 53511.*

ABOVE AND BEYOND

Peter H. Putman KT2B
84 Burnham Road
Morris Plains NJ 07950

THE GAIN GAME

Two beams, or not two beams, that is the question. Or rather, two beams, four beams, eight beams—we could go on forever. What's the point of all this? Simply that a bit of confusion exists regarding the stacking of beams.

Here's a typical scenario. A newcomer to 432 MHz invests in an IC-471, Mirage 100-Watt amplifier, and 20-element KLM beam. After chasing DX and working numerous grid squares, he decides to improve his station's performance by stacking another 20-element beam above the first, under the premise that, "if one is good, two must be twice as good!" Uh, not *exactly*.

Gain, which is a much-misunderstood and much-discussed quantity, *does* behave in a logical and orderly manner: It is a logarithmic function, unquestionably and irrevocably. Simple calculations show that doubling transmitter power results in 3 decibels (dB) of gain. Halving that power results in a loss of 3 dB of gain. Our intrepid UHFer doesn't quite grasp this concept yet as he pores through the KLM catalog. "Hmm... if I add another 20 elements, I can add another 17 dB of gain to my existing 17 dB of gain!" Whoa, Charlie. If it was *that* simple the CIA would be using it already, and amplifier makers would be out selling apples or pencils!

Refer to the previous rules of gain: Doubling your transmitter power results in only 3 dB of gain. So doubling your antenna size results in only (you guessed it) 3 dB of gain also! Not fair, you say? Those are the laws of physics and, while they can't be changed, there are some useful aspects to stacking your antennas, as well as constructing multiple-yagi arrays. For one thing, the more antennas you use in your array, the smaller the capture area, or "aperture," becomes. This can be very handy when chasing weak stations.

Of course, it goes without saying that the front lobe of the antenna is sharper, and the beamwidth somewhat smaller (assuming that we treat the entire multi-yagi array as one electrical antenna in space). The side lobes become smaller along with the inherent side-lobe rejection characteristics of sharper antennas. And the front-to-back ratio will increase as well. There certainly are many compelling reasons to start stacking those beams!

Now our intrepid UHFer has dropped another $100 on a 20-element yagi, and the necessary power divider has been procured. After installation, providing the correct spacing rules of one-half the boom length have been observed, he should see about 3 dB more gain on both transmit and receive. Assuming half his power was making it up the feedline previously, he now has an erp of about 5000 Watts as opposed to approximately 2500 Watts before (50 Watts × power gain of 100, or about 20 dB).

That's certainly a respectable signal, but he isn't satisfied. Now he thinks he'll add two more yagis and get another 6 dB of gain. Whoops! Remember the rule of gain: Doubling the previous array will buy another 3 dB. So by using four antennas instead of one, he's been able to add another 6 dB on transmit and receive. His total investment is about $300 dollars for another 6 dB. Is it worth it? Of course. Any gain you can pick up at 432 MHz, or any VHF/UHF band for that matter, is a bonus. Whether you choose to accomplish it by using more power or bigger arrays is the choice you've got to make.

Purchasing a Henry 2004 isn't going to reduce your capture area and make your antennas sharper. On the other hand, a four-element array isn't going to give you 9 dB of gain, either! This is why station improvements generally cover all bases, from preamplifiers to power amplifiers *and* bigger arrays (not to mention lower-loss transmission lines!).

I can almost anticipate your next question: What's the practical limit for stacking arrays?

There are several limitations to consider as you start to approach the monster yagi configurations. The first is the quality of the connectors and phasing lines. Consider an array of sixteen 20-element 432-MHz yagis. The theoretical system gain is on the order of 28–29 dB, assuming a single yagi has 17 dB of gain. That would certainly give anyone a whopping signal, for with 100 Watts of drive the erp would be on the order of almost 100 kW! This is a common array for moonbounce (EME) work, and it has a very sharp pattern as well as a small aperture—two important requirements for moonbounce.

But before you buy sixteen yagis, you need a few other things. Like five four-way power dividers. And *twenty* separate phasing lines. Not to mention a bit of room to put the whole thing up in. And it wouldn't be a bad idea to own some stock in a coaxial-cable manufacturer, either!

Imagine: Twenty separate but electrically identical feedlines. The first takes your main feed and splits it to the other four dividers, which in turn each feed four yagis. Alignment must be precise. Connectors must have very low loss. So must the power dividers themselves, and most commercially-manufactured units exhibit loss figures of under .1 dB. The Parabolic four-way dividers from Germany, for example, claim .07 dB insertion loss per unit.

But enough of the ideal; let's move into the real world. Assuming the average ham is assembling such an array with reasonably good connectors (type N) and high-quality cable (8214 or 9913), it would be not at all unrealistic to assume an individual insertion loss of .5 dB at each four-way junction. Since there are five junctions, this works out to $.5 \times 5 = 2.5$ dB total insertion loss. Even if we were able to get this down to 1.5 dB total, that still means that by going from eight to sixteen yagis the net gain isn't even 3 dB—only 1.5 dB. If another sixteen yagis and the requisite twenty additional phasing lines and five extra power dividers were added, the theoretical gain would be another 3 dB but the theoretical insertion losses would *also* be 3 dB! And there you have it—the break-even point.

Of course, there are many EME types that are using monster arrays. Many of

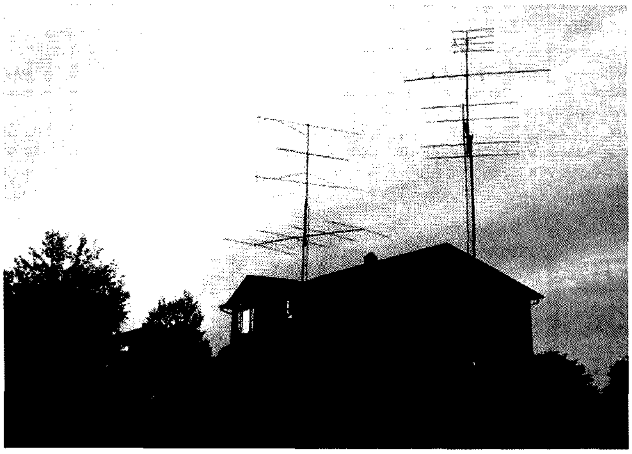


Photo A. The antenna farm at KC2PX.

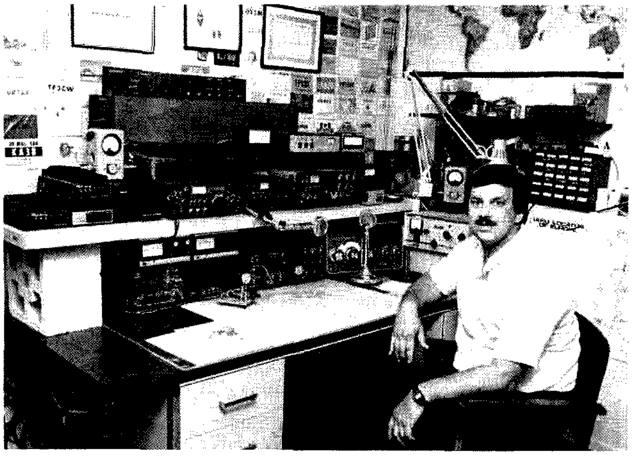


Photo B. Ivars KC2PX at his command post.

Photo C. Tom Waldron KQ3R behind the counter at the VHF Shop.

them take pride in their master craftsmanship when fabricating such arrays. But all face the same problem of gain vs. insertion losses. The other benefits of such big arrays are not lost, however. You still have narrow beamwidths, small apertures, high forward gain, and possible lawsuits from your neighbors (who regard all EME fans with a certain suspicion!).

You could spend a few more dollars and use a power-amplifier/preamplifier combination to effect more system gain while reducing the size of your array to a more manageable system. In fact, most serious VHF and UHF operators have settled on the four-bay (four-yagi) system as the most practical and economical. Such arrays offer a system gain of between 18 and 22 dB typically. The money saved on the extra antennas can be put into a medium-power amplifier and preamplifier, as well as lower-loss feedline.

As I stated earlier, spacing is also paramount. The rule of thumb for most antennas is half the boom length in vertical spacing. With some of the new "monster" long-boom antennas from KLM, Cushcraft, and Tonna, spacing may be up to a full wavelength or more. The antenna manufacturers will usually be quite happy to advise you on the proper spacing for what you might have in mind.

Always use the best grade of soft coax you can for phasing lines. Times FM-8, Belden 8214 or 9913, and Saxton 8285 come to mind readily. Make sure all of the lines are as close to being identical in length as you can make them—otherwise, you'll have phasing problems and signal cancellation. Use the best type-N connectors you can, as UHF connectors will significantly increase insertion loss (for example, how about 1.5 dB in *one* UHF connector at 1296 MHz!). The extra time spent here will result in many more enjoyable hours operating a true high-performance antenna system, and some day you just might snag that rare grid you've only dreamed about!

Profile

As I stated when this column began, I'd like to hear from you! About your station, operating habits, antennas (including those 16-yagi arrays!), and anything you've built. Send along pictures if you can! Black and white are best, but I can work from slides or color prints if I need to. Make sure that your shots are clear and sharp.

This month, our feature is on Ivars Lauzums KC2PX of Belle Mead, New Jersey. Ivars has been active for twenty-five years and is a real VHF/UHF enthusiast! Refer to the photos and you'll see what I mean. Photo A shows his QTH with its twin 40-foot towers of Rohn 25 supporting the fol-

lowing: On the left, two 19-element Cushcraft Boomers at 50 feet and a KLM 14-element yagi in the center for 220 MHz (which is being upgraded to 22 elements). Below that is a Wilson Tribander for 20, 15, and 10 meters.

On the right tower, we see four 21-element F9FT Tonna yagis for 1296 MHz at 55 feet and below that a single 7-element KLM beam for 50 MHz. Finally, at rotor level are four 19-element RIW 432-MHz yagis. GaAsFET preamps are used on the tower for 144, 432, and 1296 MHz.

Inside, the station lineup includes Kenwood TS-820 and TS-830S transceivers which, in addition to being used as low-band rigs, also serve as transverter drivers. On 50 MHz it's the 830S feeding the new Mutek TVVF50 transverter driving a Henry 6N2 linear at a kilowatt. On 144 MHz the 830S drives a Microwave Modules MMT 144/28 transverter, which also feeds the Henry 6N2 for about 700 Watts. On 220 another Microwave Module transverter (MMT 220/28) drives a Mirage C1012 to about 130 Watts output.

Finally, on 432 MHz a TS-820 drives still another Microwave Modules MMT 432/28S, which feeds a Mirage D1010 for about 140 Watts output. And 1296 operation is achieved by using an ICOM 251 with a Mutek front end to drive an SSB Electronics LT23S transverter, which runs 10 Watts output. By the time you read this, Ivars will no doubt have added an amplifier on this band.

Does he get out? You bet, and good enough for a second-place national single-operator finish in the June, 1984, VHF QSO Party—not to mention a third-place national single-operator spot in the January, 1985, VHF Sweepstakes! Ivars says that experimenting with VHF and UHF propagation as well as contesting are his two big interests in ham radio. He still wonders how he was able to get all of that aluminum up in the air without his wife Mara leaving him! Seriously, though, Mara is a big supporter of Ivars' hamming endeavors, although not a ham herself. Ivars is currently teaching his son Andris (age 2) the code and some theory. Well, you might as well start 'em off early.

Another Profile

I'd also like to use this space to introduce our readers to Tom Waldron KQ3R, who recently took over the VHF Shop of Mountaintop, Pennsylvania. Tom is a dedicated VHF/UHF enthusiast and a member of the famous K3YTL VHF/UHF contest team heard each summer from eastern Pennsylvania—all the way up to 10 GHz! Although the store isn't in the best place for walk-in customers, they sure do a whopping phone-order business, based on the number of calls that came in while I was visiting with Tom and his wife Donna.

He has a large inventory to select from, is the exclusive US distributor for SSB Electronics of Iserlohn, Germany, and also carries F9FT/Tonna, Parabolic, Mutek, and Microwave Modules—all from Europe. He's an authorized dealer for Kenwood, Yaesu, Mirage, Astron, and Henry Radio. So the VHF Shop is well stocked for the VHF/UHF crowd. The SSB Electronics line in particular stands out as an exceedingly well-engineered line of preamps, converters, transverters, and amplifiers, some of which are available as kits. You'll be hearing more about this company in the future as I intend to review several of their products. One of them that is gathering a lot of attention is the LT23S 1296 transverter, which is the first attempt I've seen at a self-controlled transverter for this band that takes a wide range of power input (10 mW to 10 W at either 144 or 28 MHz) and produces 10 Watts out at 1296 MHz. It features a GaAsFET front end and built-in switching for a mast-mounted preamp. Quite a few are in service already locally.

The VHF Shop's hours are 10:00 am to 4:00 pm Monday through Friday, and 10:00 am to 1:00 pm Sunday. The toll-free number is (800)-HAM-7373 (in Pennsylvania (717)-474-9399), and their address is 16 South Mountain Boulevard, Mountaintop PA 18707. See you on the high bands!

FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

SATELLITE TV

Yesterday was a big day for me. After months of planning and saving, I finally took the plunge and had a satellite-TV system installed.

I'll admit, I took the coward's way out. Instead of doing it myself, I assigned the job to a local satellite-TV company. I designed the layout of the system but elected to leave the dirty work to others. If there's anything I hate more than 20 meters on a Sunday afternoon, it's back-breaking work.

Still, having the system installed was not easy. After all, I live in New York City where nothing is easy.

In most areas of the country, putting up a satellite system involves little more than coughing up the bucks, finding a suitable location for the dish in your backyard, and setting up the equipment. Installing a system in New York, like getting to work in the morning here, is an adventure.

My house is located on a lot that's a whopping 25 by 100 feet in size. That's barely enough room for a decent size house, not to mention an 11-foot dish and associated equipment. So, after a preliminary site survey, I decided the best spot for the dish would be on the roof of my garage—which is located on the back perimeter of my ludicrously small backyard.

When S-Day arrived and the installation team arrived, my neighbors sprang into action. "I don't like it. It's ugly!" shouted one burly neighbor who bears more than a slight resemblance to Andre the Giant. "And it's going to sterilize us!"

Attempts to assuage the fears proved fruitless, and "Andre" waddled away muttering vague threats of lawsuits and complaints to the FCC.

Other neighbors came over alternately to congratulate and curse at me. Andre called the cops in an attempt to halt the installation (they wouldn't come) and called in inspectors from the New York City Buildings Department and Office of Telecommunications, both of whom said, in effect, "You are out of your mind."

So now I have access to some 16 satellites but no communications with that neighbor, who just sort of stands around muttering noises while watching my beautiful parabola scanning the heavens.

But a break may be in the offing. A friend of Andre's, a Franklin Pangborn type, asked me this morning if he could come over to watch a ball game that would be blacked out on local TV. I'm still pondering the matter. Heh-heh!

ELEMENT 1
MULTIPLE CHOICE

1) Which of the following satellite-equipment manufacturers was *not* a ham-equipment maker at some time?
 1) Wilson Systems
 2) KLM Electronics
 3) Chaparral Communications
 4) R. L. Drake

2) On what date was AT&T's TELSTAR I launched?
 1) July 10, 1959
 2) July 10, 1960
 3) July 10, 1962
 4) July 10, 1964

3) How much power does the typical satellite put out?
 1) 5 milliwatts
 2) 5 Watts
 3) 50 Watts
 4) 500 Watts

4) Canadian satellites are named:
 1) ANIK
 2) CANADASAT
 3) TELECAN
 4) There are no Canadian satellites

5) What is the approximate altitude of the average communications satellite?
 1) 2.3 miles
 2) 230 miles
 3) 2,300 miles
 4) 23,000 miles

ELEMENT 2
TRUE-FALSE

		True	False
1)	The belt in which communications satellites are located is named after noted science fiction author Arthur C. Clarke.	_____	_____
2)	Distorted red color on a received picture is commonly called "sizzling."	_____	_____
3)	The feedhorn is positioned at the focal point of the antenna.	_____	_____
4)	TV satellites operate in the frequency range of 3.5 to 6 GHz.	_____	_____
5)	Approximately 200 telephone channels can be crammed into a single satellite-TV transponder.	_____	_____
6)	The newer satellites carry 12 TV transponders.	_____	_____
7)	Low-noise amplifiers (LNAs) are usually rated in decibels.	_____	_____
8)	A "feedhorn" is a type of amplifier.	_____	_____
9)	WOR-TV is based in New York City.	_____	_____
10)	Home satellite installations require an FCC license.	_____	_____

ELEMENT 3
MATCHING

Match the service in Column A with the satellite/transponder in Column B.

Column A	Column B
1) WPIX-TV	A) GALAXY 1, 2
2) MTV	B) GALAXY 1, 9
3) Nashville Network	C) COMSTAR D4, 19
4) WOR-TV	D) SATCOM F4, 19
5) Odyssey Channel	E) TELSTAR 302, 12
6) ESPN	F) SATCOM F4, 12
7) American Extasy	G) SATCOM F3R, 15
8) WGN-TV	H) SATCOM F3R, 11
9) VH-1	I) GALAXY 1, 3
10) The Playboy Channel	J) SATCOM F4, 23
	K) GALAXY 1, 15

ELEMENT 4
FILL IN THE BLANK

1) RCA operates satellites named _____
2) Western Union operates satellites named _____
3) Popular satellite-TV mono audio subcarrier frequencies are _____MHz and _____ MHz.
4) COMSTAR satellites are operated by _____
5) The first premium movie channel to appear on satellite (in 1976) was _____

THE ANSWERS

Element 1:
1—3, 2—3, 3—2, 4—1, 5—4.

Element 2:

1—True	Clarke, an electrical engineer, was an early proponent of communications satellites.
2—False	"Sparklies."
3—True	Where else?
4—True	Commonly known as the C-band.
5—False	More like 2,000.
6—False	24.
7—False	In degrees (Kelvin).
8—False	Antenna.
9—False	Secaucus, New Jersey.
10—False	Not any more.

Element 3:
1—D, 2—H, 3—A, 4—K, 5—J, 6—B, 7—C, 8—I, 9—G, 10—F.

Element 4:
1—SATCOM
2—WESTAR
3—6.2, 6.8
4—COMSAT
5—Home Box Office (HBO)

SCORING

Element 1:
Five points for each correct answer.
Element 2:
Two and one-half points for each correct answer.
Element 3:
Two and one-half points for each correct answer.
Element 4:
Five points for each correct answer.

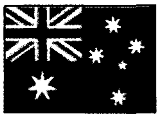
How did you do?

1-20 points	You're still listening to the Philco.
21-40 points	You think a dish is something you eat off of.
41-60 points	You pirate HBO with an MDS downconverter.
61-80 points	You opted for a seven-foot dish and love GALAXY 1 because that's all you can receive.
81-100 points	You *uplink* to the satellites from your home-based production facility.

73 INTERNATIONAL

Each month, 73 brings you ham-radio news from around the world. In this collection of reports from our foreign correspondents, we present the latest news in DX, contests, and events, as well as keep you abreast of the technical achievements of hams in other countries.

If you would like to contribute to your country's column, write to your country's correspondent or to 73 Magazine, Pine Street, Peterborough NH 03458, USA, Attn: Perry Donham KW1O.



AUSTRALIA

J. E. Joyce VK3YJ
44 Wren Street
Altona 3018
Victoria
Australia

SPECIAL PREFIX—VT

All Australian radio amateurs will be able to use the alternative prefix of Victor India (VI) from June 1 to December 31, 1985, to celebrate the Wireless Institute of Australia's 75th Anniversary. This will be the first time VI has been available for use throughout VK—although the prefix was used for a short period for a local event in VK3. The WIA is encouraging radio amateurs to use VI only if they intend to QSL with a card bearing the prefix.

SO MOTE IT BE

How often have we as amateurs heard only years later of the passing on of one of our on-air mates of many years standing? These contacts sometimes extend over half a century, but we get the news of this long-time amateur's passing too late to reflect on what they have done for amateur radio.

Peter VK3CIF was one such amateur. Born October 14, 1917, Peter became a Silent Key on March 3, 1985, after a short illness.

Peter lived for 40 years in East Africa, where he was employed by the British Colonial Civil Service. During this period of his amateur-radio activities, Peter held the following callsigns: GD3PBD, VQ4PBD, VQ5PBD, VQ1PBD, G3PBD, 5H3PBD, ZD6PBD, 9J2PBD, OE1ZBW, YA1PBD, and ZL1BDC.

In his latter years in Australia, Peter was a staunch member of the WIA, and in 1971 he was elected to the position of Secretary/Manager. Peter continued as a member of the Executive of the WIA for a further 10 years. So mote it be, another old-timer, who has given so much to amateur radio and the craft, becomes a Silent Key.

QSL EUTHANASIA

At least 50,000 unclaimed QSL cards are being held at the Wireless Institute Center. These are for QSOs made as long as five years ago, and keeping them creates a storage problem. It is unfortunate, but necessary, that the unclaimed cards be destroyed later this month.

Do you have QSLs waiting to be claimed? Many limited calls would particularly be surprised to learn that they have cards, even DX cards for six-meter contacts.

NET CONTROLLER EXTRAORDINAIRE

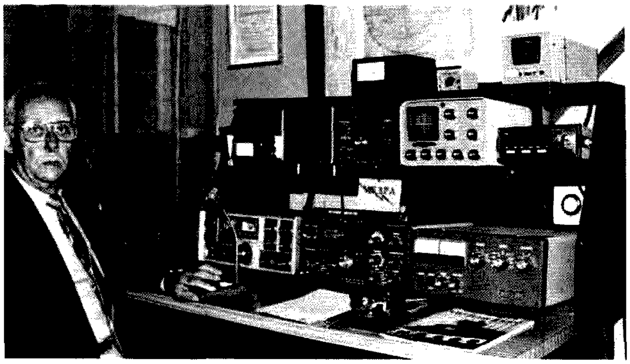
Without doubt the most respected and experienced DX net controller within Australia and its outlying islands, including VK9 and VKØ, is Percy Anderson VK3PA, who has, over the years, gained a reputation of unselfish devotion towards helping other amateurs less fortunate than himself. That is a far cry from some of the present-day DX net controllers who seem to be interested only in their own multiband DXCC or WAX.

Not so, Percy. When asked how many countries he has worked, his comment is: "I don't know how many I have worked and don't care, as long as the other people with low power and dipoles get what, to them, is a rare one!"

How often have you checked into a DX net only to have the net controller put through his checked-in-later friends, relations, or friends of friends, etc.? Then when your turn comes, the rare DX station is QRT.

Not so with Percy. If you check in as number 5, 10, or 25, that is when you will be called, regardless of all those breakers who get special privileges from less-experienced controllers, interested only in self-gain or commercialism of amateur radio.

You know the type, "QSL via my manager, or direct via the *Callbook*." They will even give their PO Box, etc., over the air, while the rest of us wait. But try not to include IRCs or green stamps with your request for a QSL card, and it somehow gets "lost in the mail." However, if green stamps are included with your QSL card, it is back in a flash.



Percy VK3PA at his desk.

Percy was a natural to be a net controller, with his background in radio. As a retired Senior Radio Technician with the Australian Broadcast Commission, Percy was first licensed as an amateur-radio operator in 1928 and, as such, has seen the advances in amateur radio from the spark generators of old to the new computer state-of-the-art transceivers.

But nothing gives Percy greater pleasure than his prize-winning vegetables. Recently, at the local show, some of his tomatoes were the size of grapefruits! His other love is the ANZA (Australia, New Zealand, and Africa) net that he started in 1971.

This was a natural progression from when he and several VK and ZL stations had a daily sked with several African stations. This soon expanded, with other rare stations and DXpeditions joining into this daily get-together until, at Percy's instigation, the ANZA net was formed.

This net has now been active for the last 15 years. The major frequency is 21.203 MHz at 0500 UTC during the high point of the sunspot cycle, but during the present low, the net has QSYed to 14.135 MHz at 0500 UTC.

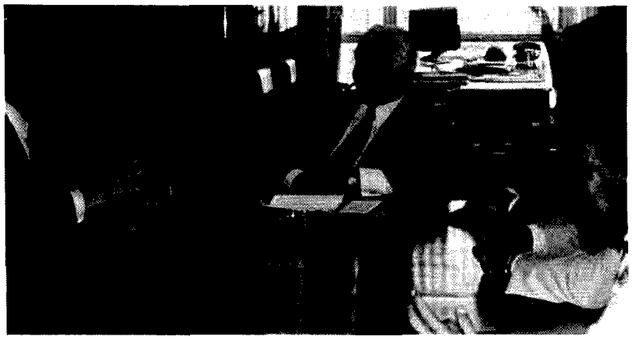
Many VK and P29 Novice operators, not allowed to operate above 21.200 MHz, also owe their DXCC to Percy. As many as 100 at a time used to listen to Percy on his ANZA net during the last high in the sunspot cycle. When a rare station appeared on frequency, after working the full-call amateurs, Percy would ask him to go down to the Novice section around 21.195 MHz, and give them a rare station to work.

Many of the rarer stations still check into Percy's net, with stations like 5X5GK, 7Q7LW, 9J2BO, 5Z4EG, FT8XA, FH4AA, FH8CB, plus ZS stations from ZS1 to ZS6. Most of the Pacific islands check in regularly, also. This is a compliment indeed from the rarer stations throughout the world to he whom we in VK feel is our best DX net controller: Percy VK3PA.

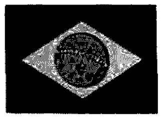
WIA 75TH YEAR CELEBRATIONS

As part of the WIA's 75th Anniversary activities, the Victorian Division (VK3) is gathering material for a time capsule to be opened in 2010, the centenary year of the WIA. This capsule will include QSL cards, a callbook, photographs of both present-day and past amateurs, plus other data pertinent to amateur-radio activities, both past and present.

There is also on the air, at present, the callsign VK75A. This callsign, celebrating WIA's 75th year, was issued to the WIA for use between 1st March and 31st December, 1985, and will be used from various parts of Australia, including VK9 and VKØ (we hope!!). All QSL cards are via the VK3 Bureau and should be collectors' items.



Minister Antonio C. Magalhaes and LABRE's President Francisco Queiroz PT2FR.



BRAZIL

Gerson Rissin PY1APS
PO Box 12178 Copacabana
20000 Rio de Janeiro, RJ
Brazil

Carlos Vianne Carneiro PY1CC
Rua Afonso Pena 49, Apt. 701
20270 Rio de Janeiro, RJ
Brazil

MINISTER OF COMMUNICATIONS

The new Brazilian Minister of Communications, Antonio Carlos Magalhaes, received in his office the president of the Brazilian Amateur Radio League (LABRE), Francisco J. Queiroz PT2FR, who came with all his staff.

Minister Magalhaes noted that for more than fifty years Brazilian hams have been able to help the people and the authorities, and that the government is thankful for all those benefits. The Minister said also that among all hobbies, our activities are the most helpful for the community, and during the time he would be heading the Ministry of Communications he would like to be always ready to help solve our problems. The Minister asked President Queiroz to transmit to our big group of 70,000 Brazilian hams his thanks for everything done and his wishes and hopes for what they would be able to do in the future for the people and for our country.

DX OPERATION IN SAO TOME AND PRINCIPE

Every year the Brazilian Navy makes trips of diplomatic nature to a few African countries. In 1984, part of the trip included a sixty-hour visit to the Democratic Republic of Sao Tome and Principe.

This time, Jose Dias Costa PS7ABT, a 46-year-old sergeant of the Brazilian Navy, was on board the battleship *Forte de Coimbra* and, as usual, he brought with him his ham equipment. That was his second trip to Africa, and the QSOs he made with his family and also between the crew and their relatives helped Jose Dias enjoy his free time.

After visiting Ascension Island and Santa Helena Island, the ship finally arrived at Principe on Monday, October 22, at 0615 UTC. The same day, during his first QSO maritime mobile, Dias discussed with his friends how important a DX operation from Sao Tome and Principe could be. After the establishment of the new government a few years ago, amateurs were forbidden to operate there.

To get a license in a foreign country usually requires time and patience. In that case, time was the main enemy. Next day, Dias contacted Karl M. Leite PS7KM (the

Karl PS7KM and Dias PS7ABT.

vice-director of the Seccion Communication of LABRE in the state of Rio Grande do Norte) and asked him about the possibility of DX operation in Principe. Karl encouraged him to try to get the license and do everything necessary to have the operation accepted for the ARRL DXCC directory. After the QSO, Dias left the ship and went immediately to the Ministry of Transportation and Communication.

During a few hours, Dias explained to the authorities the importance of that operation—and finally they decided to give him permission for the next day. Dias returned to the ship as soon as possible and immediately turned on his radio aboard to tell his friends in Brazil the good news in order that they could QSP the information on the bands.

On the morning of October 24, Dias went to the Ministry of Transportation and Communication, where he met Mr. Joao Oliveira, representative of the Ministry. At about 1000 UTC he finally got the call PS7ABT/S9 and returned to the ship to get his equipment and antennas for the expected operation. The authorities gave him only a one-day permission, so he had to be very fast. At just 1143 UTC, on 14.152 MHz, he had his first QSO with Gerald PS7BE. Due to the strong pileup, he moved on first to 14.165 MHz and then to 21.295, up to the end of the operation.

The last QSO was with Carl N4AXR of Tennessee. After the operation, the *Forte de Coimbra* departed Principe and went to Gabon and Nigeria before returning to Brazil. The QSL manager for the PS7ABT/S9 operation is Karl PS7KM, PO Box 385, 59000 Natal, RN, Brazil.

Dias sent to the ARRL a copy of the license issued by the Ministry of Transportation and Communication of the Democratic Republic of Sao Tome and Principe, and also a declaration of the commander of the battleship, certifying his stay in Principe.

de PY1APS

CHANGES IN BRAZILIAN RADIO AMATEUR SERVICE

Until last June, 1985, anyone trying to take an examination for radio amateurs in Brazil couldn't do it unless he/she proved to be affiliated with a nationwide radio amateur association, and, according to official specifications, only LABRE fulfilled such conditions.

If this requirement resulted in special convenience for both LABRE and DENTEL (Brazilian National Department of Telecommunications) due to a perfect understanding and control of all matters concerning radio amateur interests, many newcomers to radio didn't approve of this required affiliation to a private association.

As problems were coming to DENTEL, even lawsuits, Telecommunication authorities decided to put an end to that, and so, from June 6th on, no affiliation is needed anymore, no forced membership in any association. Newcomers will have two options: they'll be able to stay free operators, not tied to any association, or else (and we cannot understand how they will practice real amateur radio as deep as it goes) they'll join LABRE by their will, to profit by all privileges an internationally-recognized association presents, especially when it is the only one affiliated with the IARU in Brazil.

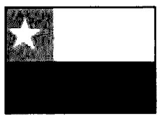
The Brazilian league, LABRE, is really to be congratulated, because now it's free of all compromises towards thousands of radio amateurs who just joined it to fulfill DENTEL's requirements and never acted much as responsible members, thus bringing a very annoying situation to the association. In fact, if LABRE eliminated all these *de jure* members, DENTEL would have to annul their licenses, and this would be contrary to the government's interest in increasing the number of Brazilian radio amateurs.

Now the whole thing is over! LABRE is free to act independently, just like any private association, according to its rules. Many newcomers from CB and many "not so deep" radio amateurs were eliminated from LABRE, and from now on we expect things to be different—a better way. LABRE's branches all over Brazil are paying special attention to this moment, development being the word, jumping into microcomputers tied to radio, equipment-mounting facilities being a new goal, and new ideas are being studied. Radio amateurs are being offered a new concept of association, reviving the spirit of the radio amateur so necessary to radio.

Programs and classes according to different groups of interest are raising interest and credit to the association, bringing associates together to their hobby, and reinforcing LABRE among Brazilian hams. We think LABRE will be the winner out of all this, and what's best, radio amateurs will discover the hard way that it is impossible to practice real radio if you're not joining international associations with all their advantages, knowledge, and development.

So, after all, what first sounded as a disaster to our LABRE in fact turned out to be the best that could happen to strengthen, to reinforce, and to promote radio amateurs and the real fantastic radio we love and practice.

de PY1CC



CHILE

Patricio Fernandez H. CE3GN
Ceramica Espejo S.A.
Calle Maipu 269
Casilia 14781
Santiago
Chile

FATHER DAVID REDDY CE0AE

Easter Island was for many years a rare catch amongst DXers all over the world. Today, many thousands of them are in debt to Father Dave CE0AE for having given them a new one.

Sadly, the once popular voice calling "CQ, CQ, this is CE0AE from Easter Island" will no longer be heard. Father Dave passed away on June 6th.

He was a wonderful man, a dedicated priest, and an enthusiastic DXer. David Reddy was born in New York in 1924 and had four brothers, two of them also being Franciscan priests. He was ordained as a priest in 1951, and after major studies in the USA, obtained a doctoral degree.

Back in the mid-sixties, he met a Bavarian Capuccine priest, Father Sebastian Englert, who was at that time in charge of the only church on Easter Island. Father Dave was so impressed with what Father Sebastian told him about the island—his social work among the natives, his archeological findings, the extreme isolation of that tiny spot full of Moais (stone statues) in the middle of the Pacific Ocean—that he promised that he would go there to help him sometime.

Father Sebastian Englert died in 1968, so Father Dave made arrangements with his congregation, and he was sent to Chile in 1969. He was first destined to Mafil, a small town in the south of the country, and he stayed there for almost three years, learning the Spanish language and preparing himself for his future work on Easter Island. During 1973 he was finally sent there, where he was until his death the only priest in charge of the small church at Rapa Nui.

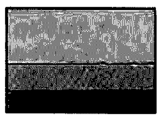
For 11 consecutive years he dedicated himself to helping the native people, and his achievements were such that he will always be remembered by all who knew him. His burial took place on the island, and the religious services were carried out by one of his brothers, a priest of the same congregation who flew to Easter Island for that purpose.

During the many DXpeditions that have taken place to Easter in the past 10 years, Father Dave helped on each and every occasion, organizing accommodations and acting as a coordinator for the DXpeditioners during their stay. I had the privilege and pleasure of meeting him on the island for the founding of the local radio club, an event sponsored by the Radio Club de Chile, back in September, 1961. After that we became great friends and talked regularly by amateur radio. On some of his occasional visits to Santiago, he visited my QTH, where he spent hours with my family, telling stories about the island.

Our usual topic of conversation on the air was, of course, DXing and how hard it was, both for him and me, to reach the DXCC Honor Roll, as we were trying very hard at it. Unfortunately, although well over the 300 mark, he was not able to make it here on Earth, but we feel sure that now, due to his merits, he has achieved a well-deserved place in the Heavenly Honor Roll.

So long, Father Dave, your friends down here will never forget you.

The late Father David Reddy CE0AE, flanked by Patricio CE3GN and his XYL.



COLOMBIA

Abelardo (Lalo) Santos V. HK3EQJ
PO Box 88937
Bogota 8
Colombia

NEW RADIO AMATEURS' REGULATIONS

The Colombian Communications Ministry has issued a new set of radio amateurs' regulations regarding the use of satellites as well as the easing of the requisites and paperwork for licensing formalities. To that end, Resolution 1554 of 5 June, 1985, was circulated by Ms. Maria Cristina Mejia, the Colombian Communications Vice-Minister, during the twenty-third National Assembly of the Colombian Radio Amateurs League held in Barranquilla on June 8, 1985.

By way of modifications to previous rulings in effect since 1983, the Radio Ama-

teur license will be issued to Colombian citizens, foreigners residing in Colombia, and to nonresident foreigners, holders of their country-of-origin's license, with which countries there are reciprocal agreements—without taking into account any age limits.

For public identification of the Radio Amateur, an ID card has been created which has a renewable validity of four years for the First, Second, and Third categories (classes).

The Novice category will be accredited by the license issuance resolution which has a duration of two nonrenewable years during which the holder ought to acquire necessary experience through his/her familiarization with radio experimentation and operation techniques.

The First-, Second-, and Third-class licenses will have a permanent character, with an excellent degree of stability for the holders and a great reduction in the amount of paperwork for both the licensees and the officials of the Communications Ministry handling the documents.

There is a summation in one article of the whole matter of the operation of radio amateur stations.

However, in the application for a license, an authenticated photocopy of the individual's valid national police certificate is required to prevent, so they say, any infringements or violations of the radio amateurs' frequencies by alien persons.

Some of the El Cocuy Radio Expeditioners taking a well-deserved rest on the way up.

A FLAG AT THE TOP; AN ANTENNA TOO!!

During the 15th, 16th, and 17th of February, 1985, a radio experimentation ascension to the 16,000-foot Cocuy peak in the Colombian Central Andean Range took place very close to the Venezuelan border, with the purpose of experimentation both on HF and VHF. It was organized by the Boyaca Province Radio Amateur Association and participated in actively by German HK7FCJ, Jorge HK7FSA, Javier HK7BNI, William HK7GQB, Milciades HK7HKU, Ricardo HK7DRV, Alfonso HK7PV/N, Al Sepulveda HK7IDO/N, and Marcos HK7IPV/N. They were accompanied by several members of the First Aid and Mountaineers Associations of Boyaca.

The El Cocuy snow-capped mountain is one of the most beautiful unexploited places in Colombia; some years ago, when there were still no satellite-tracking station facilities in Colombia, great international events were relayed from Venezuela through a Marconi Wireless Telegraph Company repeater right at the summit of the El Cocuy.

This radio expedition constituted an extraordinary human and technical effort. After the first long and tiring journey, the party fixed a makeshift camp where they had some rest and exchanged information with the backup party down in Tunja, Paipa, and Sogamoso cities (Sogamoso's ancient name was Sugamuxi, or the City of the Sun) through their VHF 23-hour-watch links. The difficult march continued then till reaching the summit.

Using their specially-assigned callsign, 5K7LRD, and during six hours of continuous operation on the 18th from 1700 to 2300 GMT, they made a total of 339 contacts on 40, 20, 15, and 2 meters. The 15- and 20-meter bands were almost dead due to the poor worldwide prevailing conditions at the time.

Not all the expeditioners were bear-looking men; there was a beauty among them, Miss Ximena Soler, the daughter of German HK7FCJ, who was an excellent assistant in all the tight situations faced during such a hard climb and descent with two Yaesu FT-707s, four FT-208Rs, two FT-209s, four 12-V 190-Ah sturdy batteries, one battery charger, and one Yamaha electric plant—not to mention tents, cables, antennas, foodstuffs, etc.

Technically it proved that El Cocuy is one of the most appropriate peaks for repeater installation as well as the most advantageous place for real VHF/UHF DX traffic, and although difficult, was not left unconquered by the brave Colombian hams of Boyaca.

THE COLOMBIAN NATIONAL COMMUNICATIONS MUSEUM

Colombia was the second country in the world to have a telegraph network as well as commercial air service, and only six years after it was invented the country had its own telephone system—and the same year Marconi started the wireless communications experiments, the first commercial broadcasting station started operations in Barranquilla, a Colombian seaport in the Caribbean. Only eight years after it was commercially developed, Colombia had its first television station.

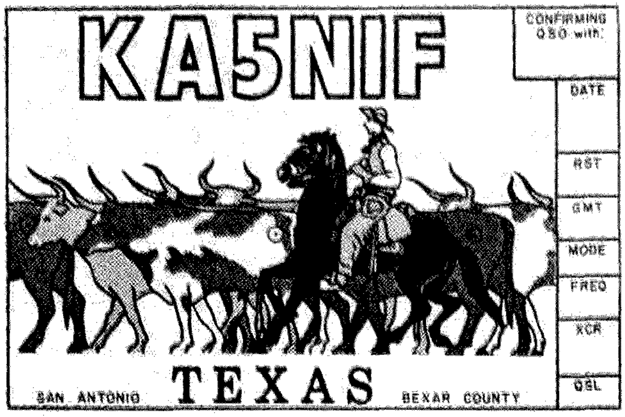
All these inventions and services, as well as their pioneers, have their technical memories, testimonies, and well-merited homages in the luxurious hall of fame of the National Communications Museum of Bogota, a place full of fantasy and charm, just like the world of communications from which it was created.

The museum is located on the third floor of the Communications Ministry Palace, which bears the name of the famous journalist, politician, and writer Manuel Murillo Toro, the twice Colombian President (1864 to 1866 and 1872 to 1874) who initiated the materialization of all those dreams.

The director of the museum is Ms. Carmen de Uribe, a multilingual, charming lady whose life has been entirely devoted to radio communications.

Among the museum's hundreds of precious relics there is the first Marconi hand key used in Colombia, one of Alexander Graham Bell's original telephones, and the first telegram transmitted between the cities of Bogota (the Colombian capital city) and Tres Esquinas (a town now renamed Mosquera, some thirty kms away) in the Cundinamarca Province.

The entrance room of the museum is an exact replica of the 1900 Necocli's (Province of Antioquia) telegraph office. The exhibition proceeds by epochs, suddenly changing in 1930 when the first telephone circuit went into operation, the telex/facsimile revolution came about, as did TV via satellite and microwave circuits, up to today's most sophisticated, fully-computerized systems. If any readers ever come to Bogota, Colombia, a visit to the National Communications Museum is a must.



QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, 80 Pine Street, Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

DEALER DIRECTORY

Culver City CA

Jim's Electronics, 3919 Sepulveda Blvd., Culver City CA 90230, 390-8003. Trades 463-1886 San Diego, 827-5732 (Reno NV).

Fontana CA

Complete lines ICOM, DenTron, Ten-Tec, Mirage, Cubic, Lunar, over 4000 electronic products for hobbyist, technician, experimenter. Also CB radio, landmobile. **Fontana Electronics, 8628 Sierra Ave., Fontana CA 92335, 822-7710.**

San Jose CA

Bay area's newest amateur radio store. New & used amateur radio sales & service. We feature Kenwood, ICOM, Azden, Yaesu, Ten-Tec, Santec & many more. **Shaver Radio, Inc., 1775A S. Winchester Blvd., Campbell CA 95008, 370-6665.**

New Castle DE

Factory Authorized Dealer! Yaesu, ICOM, Ten-Tec, KDK, Kenwood, AEA, Kantronics, Santec. Full line of accessories. No sales tax in Delaware. One mile off I-95. **Delaware Amateur Supply, 71 Meadow Road, New Castle DE 19720, 328-7728.**

Preston ID

Ross WB7BYZ has the largest stock of amateur gear in the Intermountain West and the best prices. Call me for all your ham needs. **Ross Distributing, 78 So. State, Preston ID 83263, 852-0830.**

Littleton MA

The reliable ham store serving NE. Full line of ICOM & Kenwood. Yaesu HTs, Drake, Daiwa, B&W accessories. Curtis & Trac keyers. Larsen, Hustler, Telex/Hy-Gain products. Mirage amps., Astron P.S., Alpha Delta protectors, ARRL & Kantronics instruction aids. Whistler radar detectors. Full line of coax fittings. **TEL—COM Electronic Communications, 675 Great Rd. (Rt. 119), Littleton MA 01460, 486-3400/3040.**

Derry NH

Serving the ham community with new and used equipment. We stock and service most major lines: AEA, Astron, B&W, Cushcraft, Encomm, Hy-Gain, Hustler, ICOM, Kenwood, KLM, Larsen, Mirage, Mosley; books, rotors, cable and connectors. Business hours 10–7 Monday through Thursday, and 10–5 Friday and Saturday. **Rivendell Electronics, 8 Londonderry Road, Derry NH 03038; 434-5371.**

Albany, New York
UPSTATE NEW YORK

Kenwood, ICOM, Ten-Tec, Belden, Cushcraft, Larsen, Hustler, ARRL, Hy-Gain, B&W, MFJ, Mirage. New and used equipment. Serving the amateur community since 1942. **Adirondack Electronics, Inc., 1991 Central Avenue, Albany NY 12205, 456-0203** (one mile west of Northway exit 2W).

DEALERS

Your company name and message can contain up to 25 words for as little as $150 yearly (prepaid), or $15 per month (prepaid quarterly). No mention of mail-order business or area code permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the January '86 issue must be in our hands by November 1st. Mail to 73 Magazine, Peterborough NH 03458. ATTN: Nancy Ciampa.

PROPAGATION

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA								15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40	40		20	15	15	15	15	
SOUTH AFRICA									15	15	15	
U.S.S.R.							20	20				
WEST COAST			80	80	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
SOUTH AFRICA										15	15	20
U.S.S.R.								20	20			

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20					15
PHILIPPINES	15						40		20			
PUERTO RICO			20	20	20	20	20	20				15
SOUTH AFRICA										15	15	
U.S.S.R.									20			
EAST COAST		80	80	40	40	40	40	20	20	20		

G = Good, F = Fair, P = Poor.

OCTOBER 1985

SUN	MON	TUE	WED	THU	FRI	SAT
		1 G	2 F	3 F	4 G	5 G
6 G	7 F	8 G	9 G	10 F	11 P	12 P
13 F	14 G	15 G	16 G	17 F	18 P	19 F-G
20 G	21 G	22 F	23 P	24 F	25 G	26 G
27 G	28 G	29 F	30 G	31 G		

Issue #302

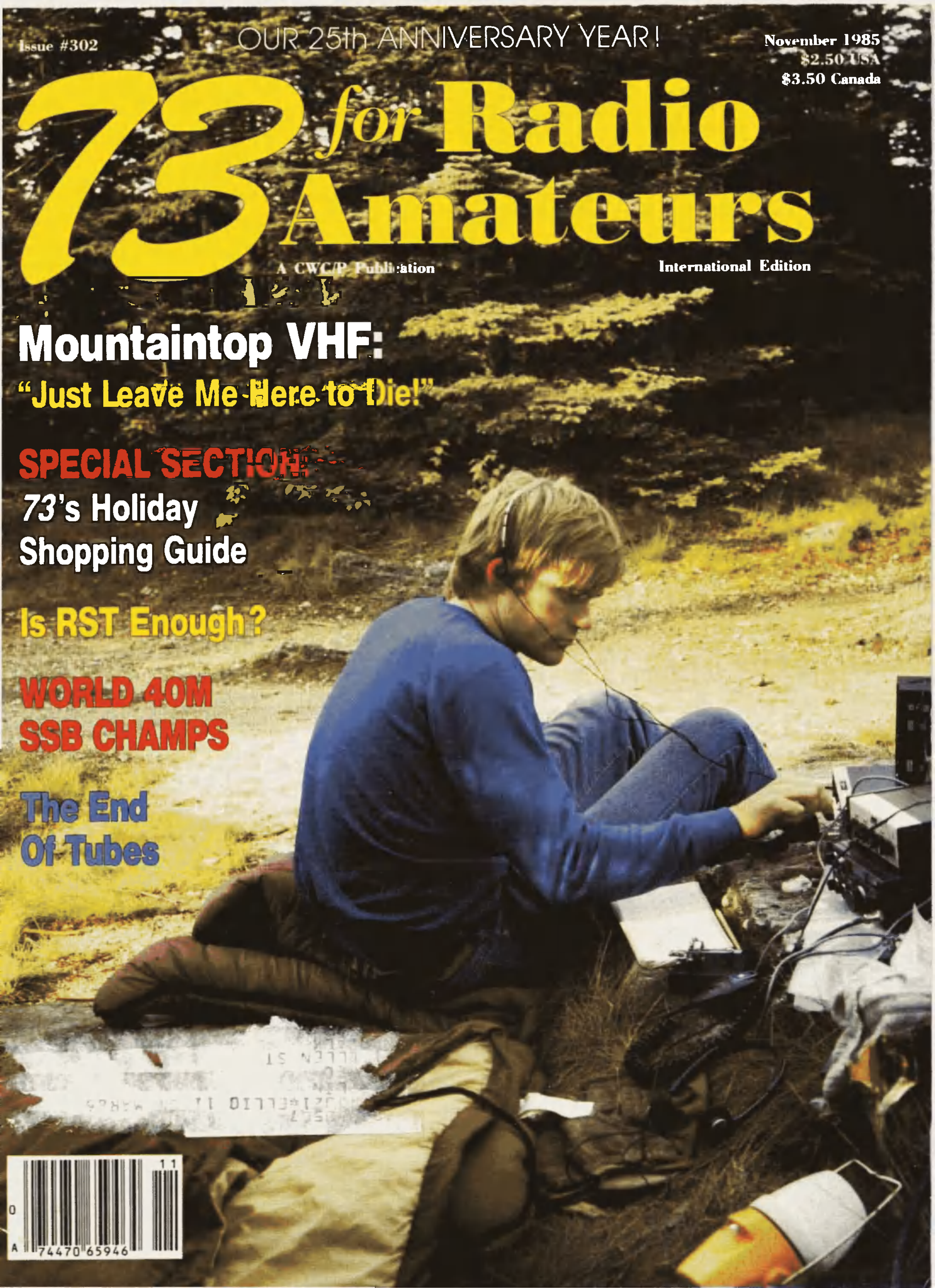
OUR 25th ANNIVERSARY YEAR!

November 1985
$2.50 USA
$3.50 Canada

73 for Radio Amateurs

A CWC/P Publication

International Edition



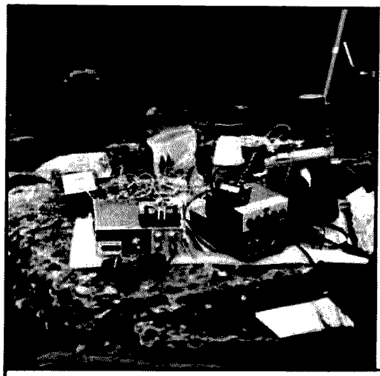
Mountaintop VHF:
"Just Leave Me Here to Die!"

SPECIAL SECTION:
73's Holiday Shopping Guide

Is RST Enough?

WORLD 40M SSB CHAMPS

The End Of Tubes



73 for Radio Amateurs®

ISSUE #302 NOVEMBER 1985

On the Cover:
73 columnist Peter Putman KT2B mans contest station K2XR/2 at the summit of Slide Mountain, New York. Photography by Steve Katz WB2WIK.

14 **"Just Leave Me Here To Die!"**
In June, 1985, two VHF contesters trudged 4200 feet to the top of Slide Mountain. Fifty-pound packs, wet weather, and pernicious porcupines were simply a part of the fun. KT2B

22 **Toss Out Your Tubes!**
Replace them with high-performance FETs—OA4KO shows you how. OA4KO/YV5

28 **Improve Your Audio Report**
Are you tired of lying to your fellow amateur? Try the QRI signal reporting system. Let him know what he *really* sounds like. W2OZH

32 **Conjure an Rf Genie**
73's Weekend Special: A 3–22-MHz signal generator/i-f aligner you can build in under two hours. K1BQT

36 **Operate OSCAR on 10 Meters?**
It's a snap—all you need is this versatile satellite converter! W6IOJ

44 **A Gentleman's Antenna**
The solution to an age-old problem: How do you fit a 160m wire onto a 40m lot? WA4BLC

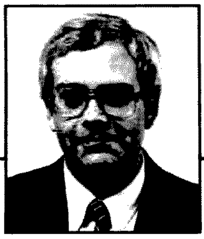
46 **Probe the Unknown**
Looking for an easy way to measure rf? Use the "electric pen," a no-load active probe with real flair! . . . . Bailey

50 **It's a Dangerous Obsession**
Growing up and learning about electronics is like driving a car before you can reach the brake pedal. KB4YJ tells how he lived through it. KB4YJ

52 **Convert and Converse**
Transform your C-64 Basic programs into Hamtext-readable sequential files. WB9AOU, WD9ADZ

4 **What?**
7 **QRX**
56 **Barter 'N' Buy**
56 **Contests**
60,70,84 **Ham Help**
61 **Special Events**
62 **Holiday Shopping Guide**
70 **Fun!**
70 **Satellites**
72 **Above and Beyond**
74 **RTTY Loop**
74 **Letters**
76 **New Products**
80 **Review**
84 **QSL of the Month**
86 ***73* International**
94 **Dealer Directory**
94 **Propagation**
95 **List of Advertisers**

Editorial Offices: Pine Street, Peterborough NH 03458, phone: 603-924-9471. **Advertising Offices:** Elm Street, Peterborough NH 03458, phone: 603-924-7138. **Circulation Offices:** Elm Street, Peterborough NH 03458, phone 603-924-9471 **Manuscripts:** Contributions in the form of manuscripts with drawings and/or photographs are welcome and will be considered for possible publication. We can assume no responsibility for loss or damage to any material. Please enclose a stamped, self-addressed envelope with each submission. Payment for the use of any unsolicited material will be made upon acceptance. All contributions should be directed to the *73* editorial offices. "How to Write for *73*" guidelines are available upon request. US citizens must include their social security number with submitted manuscripts. **Subscription Information:** Rates: in the United States and Possessions: One Year (12 issues) $24.97; Two Years (24 issues) $38.00; Three Years (36 issues) $53.00. Elsewhere: Canada and Mexico—$27.97/1 year only, U.S. funds. Foreign surface mail—$44.97/1 year only, U.S. funds drawn on U.S. bank. Foreign air mail—please inquire. To subscribe, renew or change an address: Write to Subscription Department, PO Box 931, Farmingdale NY 11737. Send Canadian changes of address to: 73, PO Box 1051, Fort Erie, Ontario CANADA L2A 5N8. Return postage guaranteed. For renewals and changes of address, include the address label from your most recent issue of *73*. For gift subscriptions, include your name and address as well as those of gift recipients. For questions concerning your subscription and to place subscription orders, please call us toll free at 1-800-645-9559 between 9 am and 5 pm or write to *73*, Subscription Department, PO Box 931, Farmingdale NY 11737. *73 for Radio Amateurs* (ISSN 0883-234X) is published monthly by CW Communications/Peterborough, Inc., 80 Pine Street, Peterborough NH 03458. Second class postage paid at Peterborough NH 03458 and at additional mailing offices. Canadian second class mail registration number 9566. Microfilm Edition—University Microfilm, Ann Arbor MI 48106. Postmaster: Send address changes to *73*, Subscription Services, PO Box 931, Farmingdale NY 11737. Nationally distributed by International Circulation Distributors.



WHAT? News from the Publisher

Although you won't really realize it, from a printing standpoint this is the first page since our STS-9 issue (March, 1984) that has been late. Mexico earthquake at 7.8. XEs going crazy, especially in Mexico City, successfully getting on the air. Shades of Managua. We will have a full report next month. By the way, unless you've been in a similar wrong place at the wrong time, you have no idea what terror feels like as the earth rolls beneath, underneath your feet.

The reason I held this page in abeyance was to be able to report, hopefully, that the FCC had done something about PRB-1. They did. The gist of it is that local ordinances regarding amateur radio—especially antennas—may now be preempted by the Commission through due process. Another way to put it is this: state and other jurisdictions "must reasonably accommodate amateur communications and represent the minimum practicable regulation to accomplish the purpose of the local authority." Why did we get this done? Because thousands of you wrote letters.

Notes:

1. When was the last time you wrote to your Representative and Senators about amateur radio? Sit down, do it, spend 66 cents in postage, absorb the cost of pencils/pens, paper, and envelopes yourself, but do it! Barry K7UGA does the best he can to help us, but he can only do in Congress what other Senators and Representatives tell him their constituents want. You don't have to say, "I support such-and-such bill." All you need to say is, "I support amateur radio and won't vote for you until you tell me *you do*."

2. My random calls went out to readers this month in Indiana and Oregon. While we're at it, I should explain in more detail my reference last month to a callee overseas who said, "No, wrong number!" I've gotten letters and calls about it. Simply put, this ham who wants to share lives in a place where political and military turmoil has suddenly surfaced. The person ended up on the wrong side of the fence in the nation, and that's why I knew, by his voice, that something was wrong. Moral: You can't even begin to know what some of our overseas friends go through, nor the danger they sometimes find themselves in.

3. What was Wayne's 25th Anniversary present? Well...even though CW Communications/Peterborough (*73*) and Wayne Green Enterprises (W2NSD) are totally separate divisions of CW Communications, Incorporated...sometimes you get lucky. One night last late winter, I happened to be in one of our other buildings on the other side of town when a CWCP employee who knew me asked what to do with a box of film found in the rafters after remodeling. This was technically CWCP's property but obviously Wayne's personal stuff, so what do I do? I examined it. Here was Wayne's history, in the 50s and 60s, in home 16mm movies...reel after reel.

Eventually, I asked trusted people who have known Wayne for some time whether they thought giving him a great gift was worth more than having him know his privacy had been breached. The answer was yes. As a result, four of us put together an hour-and-a-half VHS videotape.

4. Our Silver Eagle awards last month have brought me great grief, not to mention one possible lawsuit. People say, "Where was *I* in the 98? Where was I in the 37?" Give me a *break*, *I* say, because we can't recognize everyone. For your information, though, #26 was Jim Kyle K5JKX (1960s) and #27 was Susan Philbrick (1975-Present). I think I'll sneak them Eagles anyway. They are as much 25-year all-stars as anyone else.

Jack Burnett

MPA

73 for Radio Amateurs is a member of the CW Communications/Inc. group, the world's largest publisher of computer-related information. The group publishes 57 computer publications in more than 20 major countries. Nine million people read one or more of the group's publications each month. Members of the group include: Argentina's *Computerworld/Argentina;* Asia's *The Asian Computerworld;* Australia's *Computerworld Australia, Australian PC World, Macworld* and *Directories;* Brazil's *DataNews and MicroMundo;* China's *China Computerworld;* Denmark's *Computerworld/Danmark, PC World* and *RUN* (Commodore); Finland's *Mikro;* France's *Le Monde Informatique, Golden* (Apple), *OPC* (IBM) and *Distributique;* Germany's *Computerwoche, Microcomputerwelt, PC Welt, SoftwareMarkt, CW Edition/Seminar, Computer Business, RUN* and *Apple's;* Italy's *Computerworld Italia* and *PC Magazine;* Japan's *Computerworld Japan;* Mexico's *Computerworld/Mexico* and *CompuMundo;* The Netherland's *Computerworld Benelux* and *PC World Benelux;* Norway's *Computerworld Norge, PC World* and *RUN* (Commodore); Saudi Arabia's *Saudi Computerworld;* Spain's *Computerworld Espana, Microsistemas/PC World, Commodore World;* Sweden's *ComputerSweden, Mikrodatorn* and *Svenska PC;* the UK's *Computer Management, Computer News, PC Business World* and *Computer Business Europe;* Venezuela's *Computerworld Venezuela;* the US's *Computerworld, Hot CoCo, inCider, Infoworld, MacWorld, Micro Marketworld, PC World, RUN, 73, 80 Micro, Focus Publications* and *On Communications.*

QRX. . .

EDITED BY PERRY DONHAM KW1O

50 Already?

KING HUSSEIN JY1 turns 50 this month, and a two-week celebration has been planned by the Royal **Jordanian Radio Amateur Society.** All Jordanian hams will sign with special prefix JY50 from November 7 to November 21, 1985. Prince Raad Bin Zeid, Chairman of the Royal Society, said, "We decided on a two-week period because propagation has been so bad. With a little luck, JY50 stations should be able to work into most call areas in the world during the two-week window." The King, using the call JY50, will join the 50 active Jordanian hams on 160 through 10 meters, all modes, and on OSCAR 10. A commemorative certificate will be given to European amateurs working 10 JY50 stations; non-European hams must contact 5 to qualify. Send a copy of your log (no QSLs are required) and 10 IRCs or $5.00 to the Royal Jordanian Radio Amateur Society, JY50 Celebration, PO Box 2353, Amman, Jordan.

Take 3

HAMS IN SPACE—AGAIN! As first reported in *73* last July, two German and one Dutch amateur will fly aboard the shuttle *Columbia*, marking the second ham-in-space mission this year. Special call **DPØSL** will be used on board Spacelab during the seven-day flight by **Dr. Ernst Messerschmid DG2KM, Dr. Reinhard Furrer DD6CF, and Wubbo Ockles PE1LFO**. The launch is set for October 30, 1985; ham operation is expected to begin on the third day and continue until twelve hours before touchdown. One important difference that sets this wholly-European mission apart from American ham-in-space efforts is the equipment to be used. Most significant is the fact that the antennas will be mounted on the *outside* of the spacecraft (rather than "making do" with a window-mounted strip). Since the Germans own the flight (NASA is merely providing transportation), the problem of modifying Spacelab to accommodate ham antennas was solved in the planning stages. The transceiver being carried aboard also is quite different from its American counterpart. Built by the Robert Bosch Company, the rig operates in a mode similar to AMSAT-OSCAR 10 mode B, receiving on 437 MHz and transmitting on 145 MHz. Six uplink and four downlink channels are available to the astronauts. The channels are: Ch. 0, 437.125 up, 145.450 down; Ch. 1, 437.175 up, 145.475 down; Ch. 2, 437.225 up, 145.550 down; Ch. 3, 437.275 up, 145.575 down; Ch. 4, 437.325 up; Ch. 5, 437.375 up. Uplink and downlink channels may be selected independently. For example, pair 0/3 would be 145.450 down and 437.275 up. The default pair, covering the bulk of communications during the flight, will be 3/3, or 145.575 down, 437.275 up. If the pileups get out of hand, expect the crew to change their receive frequency at random. Repeater owners whose machines have an output in the range 145.45–145.50 MHz should consider suspending operation during the flight to avoid interference to DPØSL. Two beacon types will be used: The first is a standard beacon signing DPØSL. The second beacon will transmit "CQ DE DPØSL RECORD ON TAPE K," followed by a one-minute period during which calls to the shuttle will be recorded. The Deutscher Amateur Radio Club (DARC) will evaluate the tape after the mission and confirm calls heard with a special QSL. There have been rumors to the effect that the three hams will be taking HF equipment on board, specifically 10- or 15-meter SSB gear, in order to study HF propagation conditions from space. Your best source of up-to-date information will be the *73* RBBS at (603)-924-9809.

Hello, Test

IT'S CONTEST SEASON again. Time to gear up for Sweepstakes, the EME competitions, and *of course* the annual **73 World SSB Championships** in January. You'll find the results of the 1985 40-meter contest in this issue, along with dates and times for the 1986 tests and a sample log sheet. Also, note this important change: There is a new central address to obtain rules and entry forms from. Send an SASE to Contest Rules and Forms, Billy Maddox KA6JJK/3, 1162 Bayview Vista Drive, Annapolis MD 21401.

Fine With Me

THE FCC IS busily handing out fines for illegal operation. In Philadelphia, fines totalling $900 were levied on **Joseph Roberson** for operating a CB radio in excess of the legal output limit of 4 Watts. Numerous TVI complaints from neighbors caused FCC engineers to look into the matter. Interestingly, Roberson has refused to allow his CB station to be inspected. Also in Philly, **Harry Jackson** was fined $750 for interfering with local television reception for a period of about 6 months. The FCC says that Jackson's CB radio was operating at 47 Watts output. In Michigan, two individuals had criminal complaints filed against them for allegedly making illegal amateur-radio transmissions. **Glenn Barrick and Richard Szabo**, if convicted of violation of Federal law, could face a maximum sentence of one year in prison and a $10,000 fine for deliberately interfering with amateur communications. **Clinton Berger** of Ridgetop, Tennessee, has been issued a fine of $1,000. Berger, located by the FCC's HF direction-finding network, is accused of illegal operation near 6930 kHz. This frequency is a hangout for the so-called "Oscar Group," a net of ne'er-do-wells that the FCC is trying to shut down. Commission enforcement officers are also looking at "Oscar Group" activity in Indianapolis and San Francisco.

They CARE

A NATIONAL VEC GROUP was formed as a result of an informal meeting of sixteen VECs in Gettysburg, Pennsylvania. The Coordinators were present for an all-day session with the FCC which essentially completed the transfer of amateur licensing into the hands of the volunteer force. As is often the case, a Friday-night "wind-down" meeting produced the most concrete results—a formal organization of Volunteer Examiner Coordinators known as CARE (Coalition of Amateur Radio Examiners). CARE will address the special problems of VECs such as universal accreditation of Volunteer Examiners, developing a common exam pool, and closer cooperation in examination scheduling. Officers picked at the meeting were **Joe Ingram K4OOV, President, Alex Magocsi WB2MGB, First Vice-President, Fred Maia W5YI, Vice-President, Jim Georgias W9JUG, Executive Vice-President, and Gordon Girton W6NLG, Secretary/Treasurer.** Membership in CARE is open to any FCC-accredited VEC, and to any individual Volunteer Examiner. You can get complete information about CARE by contacting Joe Schroeder W9JUV, Box 406, Glenview IL 60025.

Trivia

DID YOU KNOW that the very first man in space was a ham? It was April of 1961; cosmonaut Yuri Gagarin UA1LO made a complete orbit of the planet in a trip that lasted a little under two hours. Did Yuri think about amateur radio as he circled in his tiny *Vostok* capsule? Perhaps so. It is interesting to take note of other "firsts" logged by the Soviets in space: the first orbital flight exceeding 24 hours in duration,

first flight by a crew not wearing pressure suits, first woman in space (in 1963—it would be another 20 years before the first US woman would fly), and the first space walk. Oh, yes, and the first amateur-radio satellite to be launched through the garbage disposal of an orbiting space station! And speaking of satellites, congratulations to **Tom Clark W3IWI** who was honored by AMSAT at the 1985 Central States VHF Conference in Tulsa. Tom spent four tough years as president of AMSAT. Those four years saw the catastrophic loss of the first Phase-3 satellite in the Indian Ocean, and the subsequent success of its replacement, AMSAT-OSCAR 10. In recognition of his extraordinary contribution to the amateur satellite program, Tom was given the title **President Emeritus** of AMSAT. Well-earned, we think.

Mixed Groups

"YES AND NO" is the word from the FCC regarding Advanced-class amateurs administering 13-wpm code tests. Fred **Maia W5YI** had asked the Commission to review an earlier Order which dismissed a petition containing changes to the volunteer examination program, including a provision allowing Advanced ticket holders to give the 13-wpm test to General-class aspirants. In dismissing the entire petition, Maia held, the FCC acted contrary to the law. Specifically, Fred claimed that Advanced hams *are* in fact legally able to give the exam, and that allowing them to do so would greatly increase the availability of volunteer examinations. The Commission's decision? "Upon further review, we agree. The statute states that the standard to be applied is whether the examiner is of a higher class than the class for which the examination is being conducted." But, "It appears that the amateur community has risen to the challenge... to administer examinations to over 4,000 applicants each month. This is 50% above the rate...under the previous system and we feel that these volunteers are only beginning to achieve maximum efficiency. Therefore, we will continue to accept the voluntary services of only Amateur Extra operators for administration of Element 1(B) for the General Class license at this time." Yes, and no.

Leaky Lines?

HAMS EXPERIENCING INTERFERENCE from leaky cable-television lines can learn a lesson from the **Chautauqua Countywide Repeater Association** (NY). Complaints to the New York State Commission on Cable Television resulted in two cable operators voluntarily cleaning up their systems. A third company, however, was forced by the Commission to take appropriate actions to resolve the problem. Leakage from this company's lines was so severe that the only solution, short of discontinuing service, was to begin a massive rebuild of the entire distribution system! Part of the evidence submitted by the CCRA was a map pinpointing leaks along the line, complete with measurements. A total of 113 rf leaks were identified in a small portion of the cable system, ranging from 24 to 4,575 microvolts per meter (the allowable limit set by the FCC is 20 microvolts per meter). The cable operator denied any leaks and stated, "...we have no signal leakage that would exceed FCC regulations." The CCRA is offering interested hams copies of their complaint letters and information on how they made leakage measurements—send $1.00 to cover postage to the Chautauqua Countywide Repeater Association, PO Box 186, Westfield NY 14787-0186.

Good Buddies

CB-TO-TEN conversions seem to be the "in" thing these days! Lately our mail room has been flooded with letters requesting information on how to convert CBs to 10-meter service, and the office telephone has become a "conversion hotline." It seems that a number of surplus dealers are unloading Hy-Gain CB boards at bargain prices and mentioning that *73* would be happy to provide all of the conversion details. And the hams who already *have* old CBs are dusting them off. So here's the deal: We've put together a list of all of the CB-to-10 articles that have appeared in *73* (there are about thirty). Send us an SASE and we'll send you the list. Pick the article you'd like to see and send *another* SASE, and we'll send you a copy of the article. Now, we usually get a fistful of dollars for reprints, but if *you* won't tell, *we* won't tell! Send your SASE to *73* Magazine, Editorial Offices, 80 Pine Street, Peterborough NH 03458, Attn: CB-to-10.

Packet Panic!

PACKET RADIO is experiencing a tremendous growth surge here in the States and abroad. On the West Coast, **Ron Raikes WA8DED** has developed a program which replaces the software in a TAPR-I TNC. The new code is smaller and is designed to allow simultaneous connections to four stations. It also provides routing information on incoming packets, eliminating the need to use the pesky TRACE mode when deciding on a connect path. On the East Coast, high-speed UHF linking between Packet Bulletin Board Stations (PBBSs) is moving ahead at a rapid pace. Overseas hams are embracing packet radio, and PBBSs designed by **Hank Oredson WØRLI** are springing up on HF, providing local 2-meter groups access to the international packet community. The price of packet has dropped dramatically in the past few months with the introduction of the Kantronics Packet Communicator and the AEA PK-64 (both retail for around $200), and every day sees another group of first-time packeteers on the local circuits. Automatic mail forwarding has become commonplace—a message filed in New England can arrive at its destination in California in under an hour. How long will it be before the National Traffic System is replaced? Of course, packet radio is just *one* of the varied modes of communication we amateurs enjoy, and it will never oust CW or SSB, but it *is* the most exciting thing to happen to ham radio since the audion!

Beacon Begins

A NEW TEN-METER BEACON is on the air from Thomasville, Georgia. **John Mahagan WB4JHS** is conducting a propagation study in which the height of the transmitting antenna is varied. The beacon runs 7 Watts on 28.253 MHz. Send reception reports to John Mahagan WB4JHS, 220 Covington Avenue Apt. 73, Thomasville GA 31792.

SARSAT Search

HAMS IN WESTCHESTER COUNTY NY were scrambled into action when **Sal Lagonia N2EQM**, Director of Emergency Services for the Westchester Civil Air Patrol, received word that an ELT (Emergency Locater Transmitter) had been activated in his area. An ELT is a device that is turned on automatically when an aircraft crashes—the signal from it is picked up by SARSAT (Search And Rescue SATellite) and relayed to Scott Air Force Base in Illinois. Officials at Scott then notify the appropriate CAP unit. Lagonia immediately dispatched a CAP airplane equipped with direction-finding (DF) gear which narrowed the search to the area around one town. Then, two cars armed with DF receivers and hams were sent out—the first manned by **Dwight Smith N2FMC**, and the second carrying **Bob and Sarah Wilson, N2DVQ and N2EYX.** The two mobiles kept in touch with each other and with CAP headquarters on two meters. In just a few hours, the ELT was located inside a building. It had been aboard a helicopter which had made a rough landing—the pilot thought that removing the unit would deactivate it. It didn't.

Gracias!

THIS MONTH'S COLUMN had help from *The W5YI Report, The ARRL Letter, Gateway, Westlink*, and AMSAT. Do you have news that should appear in "QRX"? Send it (with photos!) to *73* Magazine, Editorial Offices, 80 Pine Street, Peterborough NH 03458, Attn: QRX.

Peter H. Putman KT2B
84 Burnham Road
Morris Plains NJ 07950

"Just Leave Me Here To Die!"

In June, 1985, two VHF contesters trudged 4200 feet to the top of Slide Mountain. Fifty-pound packs, wet weather, and pernicious porcupines were simply a part of the fun.

One of the great things about amateur radio is the scope of the hobby: Vast opportunities are open to the adventurous. There's virtually no limit to the ways one can come up with to further enjoy what's got to be one of the most expansive and exciting hobbies in the world. The possibilities are endless: DXing, operating from a boat, plane, car, raft, tent, or even the Space Shuttle, exploring the very high and very low frequencies, home-brewing elaborate equipment, and finding new ways to generate power from portable sources are just a few of the many exotic ways we can get more out of amateur radio.

It was with these thoughts in mind that I began contemplating a somewhat exotic DXpedition in April, 1985. Being an avid VHF/UHF operator and contester, I tried to think of an operation that might make the upcoming ARRL June VHF QSO Party somewhat more "memorable." Since the format of this popular contest had recently gone to using grid-square multipliers (based on the worldwide Maidenhead locator system), it seemed logical that an attempt to put a rare grid square on the air during the contest would be just that type of operation.

After several conversations with area operators and consulting past contest results, it became apparent that there were many grid squares that hadn't been heard from on one or more bands in the past few years. One in particular that stood out was grid square FN22, an area in New York State described by the coordinates between the 42° and 43° latitude lines and the 74° and 76° longitude lines (a grid square, as defined in the Maidenhead system, is 2° wide by 1° high). This area is bounded roughly by the Hudson River to the east, the New York State Thruway to the north, I-81 to the west, and the New York/Pennsylvania border and Catskill Mountains to the south.

This particular grid square manages to miss altogether such densely populated areas as Syracuse, Binghamton, Albany, Schenectady, and Utica, so VHF and UHF activity from FN22 is usually sparse. This lent further weight to my decision since you don't want to be competing against a stronger, better equipped station in your grid if you expect to get a lot of calls on a DXpedition! The only questions left to resolve were what bands to operate on, where to operate them from, and what equipment to use during the operation.

After studying the contest results of the past year, it became apparent that two bands could be considered "scarce" from FN22: 432 MHz and 1296 MHz. In fact, 1296 operation from FN22 is downright rare, since I know of only one other 1296-MHz station there (set up by Joe Reisert W1JR several years ago). The past few VHF and UHF contests have heard no activity from FN22 on this band. 432 MHz has been on from FN22, but usually only during the contest periods. John Lindholm W1XX has put a station on this band during the contests, but many contesters have managed to miss his signal.

Now that the frequencies were decided, the choice of location became paramount. Since FN22 encompasses so many square miles (7107 square miles, to be precise), I certainly had many choices. The most important factor was being near the activity. Experienced VHF/UHF contesters on the East Coast know that this means being near the population belt that stretches from Washington DC all the way up the East Coast to Boston. Traditionally, the top-scoring stations in the various VHF and UHF contests have come from between the Philadelphia area and Connecticut/Massachusetts. I needed to find a suitable spot to be able to work into this belt. It had to

be high. It had to be accessible by car. And it had to be a short distance from my home location in northern New Jersey.

One particular location was intriguing and kept coming to my attention. In the lower Catskill Mountains stands one of the higher mountains in the Northeast, Slide Mountain, which tops out at 4210 feet above sea level. Nestled in a cluster of somewhat smaller peaks (around 3700-3800 feet), it's very difficult to spot from the ground unless you happen to be by the Ashokan Reservoir on a clear day. Slide Mountain is located on the very southern border of FN22—in fact, the 42° latitude line runs across the south face of the mountain, just below the peak. (How's that for close!) What appealed to me most of all was that a station set up on Slide Mountain would have a virtually unobstructed shot to the east, south, and west, with only a slight shadow to the north/northeast from the northern Catskills.

The decision was made. Slide Mountain would be the DXpedition site. Having been up the mountain earlier in October of 1984, I felt confident that a small, lightweight backpack station could be assembled and brought up by one person. (Would those words come back to haunt me later!) The mountain itself is not accessible by car, but you can drive to the base and negotiate several trails to the top. My previous hike up had utilized the western trail, which begins at 2500 feet above sea level and rises 1700 feet in 2.7 miles of old carriage trail. Not a bad climb with a light bag—just about 1 hour to the top. And what a view! There used to be an observation tower on the mountain years ago. The best view is had by proceeding to the east face at the summit. From here you can drive repeater owners up and down the East Coast crazy with a handie-talkie and a few Watts.

About five years ago, the decision was made by the Catskill Parks Authority and the New York State Department of Conservation to restrict camping and overnight stays in the Catskills above the 3500-foot level. This was intended to curb serious erosion of the tops of many of the popular peaks. I thought long and hard about this rule, since it would put a serious crimp in any overnight operation. Perhaps, I thought, I could arrange a way to stay up, keep warm, and operate without actually setting up a permanent tent site. Of course, campfires were out of the question, so food would have to consist of trail mix and sandwiches. Hot liquids could be brought up in a thermos if needed.

Shortly thereafter, I announced my plan to Steve Katz WB2WIK, who I must say is never short on enthusiasm. He proposed that he come along to lighten the load and to allow a more sophisticated station setup. I quickly agreed, eager for the help and companionship. While we were at Dayton in April, we told as many VHF and UHF operators as we could about the impending trip. Subsequent announcements were made on as many of the East Coast VHF and UHF nets as we could check into, and personal correspondence to area hams played up the operation. After all, we wanted to make sure someone was actually looking for us when we got on the air!

I must admit we met with a little skepticism. The prevailing comment was, "If Slide Mountain is such a great location, why hasn't anyone operated from there in a contest?" Well, that was only partially true, as several stations had indeed been active back in the 60s before the camping restrictions were put into effect. But I insisted that we would persevere and those who looked for us on 1296 MHz would indeed work a rare grid square.

Work proceeded on the station equipment. Steve located and bought two motorcycle batteries, both rated at 12.5 volts and 14 Ah. To test these batteries, he first charged them up and used them to run the exciter on his 2-meter repeater for several days. After a moderate duty cycle, the voltage was found to have dropped to 11.5 volts, which was entirely acceptable. The batteries weighed in at 8 and 10 pounds.

While at Dayton, I visited the VHF Shop booth and after talking with Tom Waldrin KQ3R who runs the store, I decided to invest a couple of hundred dollars into an SSB Electronics 1296 10-Watt amplifier. The drive requirements were .5-.7 Watts at 1296 MHz, which I could supply with no difficulty from a Microwave Modules MMT1296/144 transverter. Ivars Lauzums KC2PX made available to us a Microwave Modules MMT432/144 transverter with 10 Watts of output. It was lightweight and reliable (we thought). Antennas consisted of a 21-element 432-MHz F9FT yagi from the VHF Shop and a 23-element 1296-MHz F9FT yagi I had picked up used. But what to use for masting?

Jerry Meckenberg K2JWE came to the rescue with several pieces of lightweight army masting he had in his garage. Steve selected four pieces of this mast material which weighed about 4 pounds per section, and we drilled the joining sections to allow pinning them together for added security. A South River 3-foot tripod antenna base was selected to hold the masting in place. Coax sections of 30' each were made up as feedlines, using Belden 8214 on 432 MHz and Belden 9913 on 1296 MHz. Finally, I disconnected the final-amplifier module on my Kenwood TR-9000 so as to save unnecessary drain on the batteries. The output from the driver stage (approximately 50 mW) was sufficient to power both transverters to full rated output without using the supplied 15-dB pads.

Photo A. Pete Putman KT2B loaded up with 70 pounds of equipment. The K2XR/2 expedition up Slide Mountain begins.

A short vacation trip up to Mt. Equinox in southern Vermont over Memorial Day would provide us with a test of the stations. Mt. Equinox is a popular contest site and lies just west of Manchester, Vermont. Topping out at 3850 feet, it offers truly spectacular views in all directions. We had set up several schedules with the folks back in New Jersey on both bands, hoping to make contacts that Sunday morning before we headed back to New Jersey.

Sunday morning came and with it dense rain clouds! Steve got me up at 7:30 am and we headed out to the parking lot. The air

was chilly and wet, but assembly of the masting, antennas, and two stations went quickly. All was going well until we keyed up the 432-MHz Microwave Module and discovered it was only developing 1 Watt of output. This was a strange turn, as the unit had until now been performing flawlessly. Everything else checked out OK—swr, cables, dc power—and we decided what the heck, we'd get on and see what could be worked. Contacts were made in short order with KC2PX, K2JWE, Ralph N2BMN, and others with our pip-squeak power on 432 MHz. We then tried to raise KC2PX on 1296 to no avail, even though all was well on that band. Perhaps the dense clouds were absorbing our signal. Herb K2LNS tried vainly to hear our 10-Watt signal and called a long CQ with his 100 Watts, which we did copy with some difficulty. This proved out our theory of the clouds and storm system playing havoc with the 1296 signal!

After arriving back in New Jersey, the first order of business was to repair the 432-MHz Microwave Module. Unfortunately, Murphy was with us and the unit now refused to put out any power at all! Not only that, a short then developed on the i-f board, rendering the unit useless. Not having adequate documentation on this unit, I shipped it off to Hans Peters VE3CRU for repairs and considered our dilemma. What could we use on 432 that was lightweight and reliable?

A call to Tom KQ3R at the VHF Shop followed. He told me about a 100-mW transverter he had in stock along with a companion 432-MHz 10-Watt amplifier from SSB Electronics. The price sounded reasonable and I traveled out to Mountaintop, Pennsylvania, to meet Tom in person and pick up the two units. The transverter was preassembled

Photo B. KT2B trying to stay warm in 50° temperatures while on 432 MHz. Note the modified British Airways headset on the wool cap—lightweight and reliable.

(which was a real time-saver) but the amplifier was a kit. Tom assured me it was a quick 2-hour kit and, not one to be afraid of a soldering iron, I took it home and set to work.

The amplifier did indeed go together quickly, but I was unable to obtain more than 4 Watts of output from it with full drive. Substituting several transistors resulted in more output, but only about 6-7 Watts maximum. The amplifier developed an instability condition and blew two rf chokes as well as the driver. I was convinced that Murphy was indeed wielding his influence over our DXpedition. Finally, a decision had to be made and Steve made it—he modified his KLM Echo 70 432-MHz transceiver to have agc and to accept a Janel 432-MHz GaAsFET preamplifier. It was heavy, but it was all we had left to fall back on—and there were only three days until our trip started! As bad as I felt about taking all that extra weight, I had no choice left.

Friday night found the two of us boxing up supplies, radios, cables, food, and drink. I finished the weigh-in and came up with some distressing news: The total weight would be just over 50 pounds per person! That's not a light load, especially when you haven't gone mountaineering or backpacking in about ten years. The problem was that nothing could be eliminated to reduce the weight load, as we had pretty much cut everything down to the essentials (or so we thought). Two multimode radios, one transverter, one power amp, four mast sections, two antennas, a wattmeter, two batteries, keyers, paddles, phones, two sleeping bags, a tent, two canteens, ponchos, coax, tools, clip leads (essential items), food, clothes, and flashlights comprised our equipment list. Not only that, we managed to stuff just about all of it into two Kelty backpacks.

Saturday, June 8, 1985, dawned cool and rainy. Oh, no—not another repeat of Mt. Equinox! I called Steve and said that, unless it was hailing or severe thunderstorms were raking Slide Mountain, we ought to try it. He agreed, and an hour later we were on our way to the mountain.

A quick stop for a late breakfast at Homer's in Port Jervis allowed us to load up our stomachs and save space for the dinner materials in our backpacks. 90 minutes later we arrived at the base of the mountain, having driven through alternate rainy and sunny weather. It looked like the storm system might break after all! We pulled into a sheltered parking area at the base of the trail and began loading each other up. Let me tell you, 50 pounds may not sound like much, but when it's on your back it feels like 150 pounds! In fact, we both became quickly aware that we had brought more than 100 pounds of stuff with us. The ranger on duty helped us load up and estimated my pack to be close to 70 pounds! Steve's pack weighed in at 50 or more, so our work was definitely cut out for us this morning.

Whatever we couldn't put into the packs we strapped to our backs using elastic stretch cords—God's gift to backpackers. I wound up with the TR-9000, Echo 70, 1296 amp, one battery, flashlight, canteen, tools, food, clothes, sleeping bag, tent, and the two antennas (broken down and wrapped in our ground cloth). Steve carried the 1296 transverter, the other battery, both keyers, paddles, coax, water, thermos, food, tripod, the other sleeping bag, and flashlight. In addition, we both carried two sections of mast material. Photo A shows me loaded up.

We started out minus one canteen and the wattmeter, since room and weight precluded either. Our reasoning was that if the stations didn't work right now, there wasn't anything we could do about it at the top. Also, there is a spring near the top on the east trail, although it's quite a climb if your relatives aren't mountain goats. The trail immediately got rough, with a steep climb up an old stream bed and some rocks in order to join the abandoned wagon trail. At this juncture, 2 miles from our objective, we knew we were in trouble. Both Steve and I were very overloaded. We stripped down to T-shirts and shorts to cool off and

had to make frequent "back breaks" to reduce the strain on our shoulders. Carrying two masts apiece added to our discomfort, since we couldn't use our hands to pull up the back frame and readjust its weight on our backs.

To further complicate matters, it began to rain again. At the lower elevation this wasn't a big problem because the dense tree cover kept us dry. As we started edging closer to the 3000-foot mark, it became quite wet and we were forced to put ponchos on. The going was very slow, and the packs felt like boulders! Steve in particular was getting *very* tired, and not being inclined to be tried for "hamicide," I suggested frequent rest breaks with the packs off. These worked well, except we didn't want to put the packs back on afterwards! Needless to say, we were constantly gulping down the contents of our lone canteen, secure in the knowledge that somewhere up there was a running spring. The trail mix came in handy for energy, but there was no substitute for the rest periods. Steve came up with a novel method of leaning over to put the weight of the pack square on his back and relieve his shoulders. I took to leaning on the two mast sections and propping up my frame. But no amount of this rest would get us to the top, so on we trundled.

It was a great lift to our spirits when we finally reached the 3500-foot level. After all, we had been on the trail for nearly *three hours* and we were beginning to wonder if we'd actually make it to the top. What didn't make us feel so good was the number of hikers that had passed us on the way up and were now coming back down after reaching the top. This was a *slow* journey. Shortly thereafter, we attained the shoulder of Slide Mountain, where we hiked into coniferous trees and out of the rain. What a spectacular view of the Catskills! We took another rest break for 20 minutes and assessed the balance of our trip—about .65 miles. It didn't seem too difficult, since we were now hiking along a very level trail with an occasional slope upwards.

The final leg took nearly 35 minutes to go the .65 miles, as we were both just running out of energy, and it was a welcome relief to see the concrete footings from the old observation tower at the summit. We had dropped the masts about .2 miles back to allow us to use our hands while scrambling up the last few rocks on the trail. I quickly dumped my backpack (my shoulders felt just then like they were full of helium gas) and ran back down the trail to get the masts. Steve collapsed in the clearing I had picked out and took a quick nap. After a scramble to the spring to replenish our water supply, we set to work putting station K2XR/2 on the air.

The mast setup and station connections worked flawlessly. At about 7:45 pm Steve began testing each station to make sure all was working, while I wolfed down some sandwiches and trail mix. Another complication arose in that while the weather had cleared up, it was becoming very cool—in fact, downright cold. Off came the shorts and on went long jeans, a sweatshirt, and a wool hat. (At this time I thought I might be suffering from a mild hypothermic condition—since I felt severely chilled and had not eaten much—so the hat and a pair of gloves came in handy.) Steve felt fine and at 8:00 pm K2XR/2 burst onto the airwaves on 432.110 MHz. I finished my hot chocolate and soup and set about getting on 1296 MHz.

Was this a good site? You betcha! Steve worked 17 stations and 8 grids in the first hour, while I managed to contact 5 stations in 5 grids in the same period. By the way, the latter figure is a very good Q rate for a band that most people only operate on a sked basis! It was especially fun to call CQ on 1296 (unheard of most of the time) and work stations *off the side* of the 23-element beam. W1RIL in Worcester, Massachusetts, was worked in exactly this fashion, as were K3MTK in Pennsylvania and W2SZ/1 in Massachusetts. The air temperature continued dropping, so Steve and I unrolled the sleeping bags to operate from.

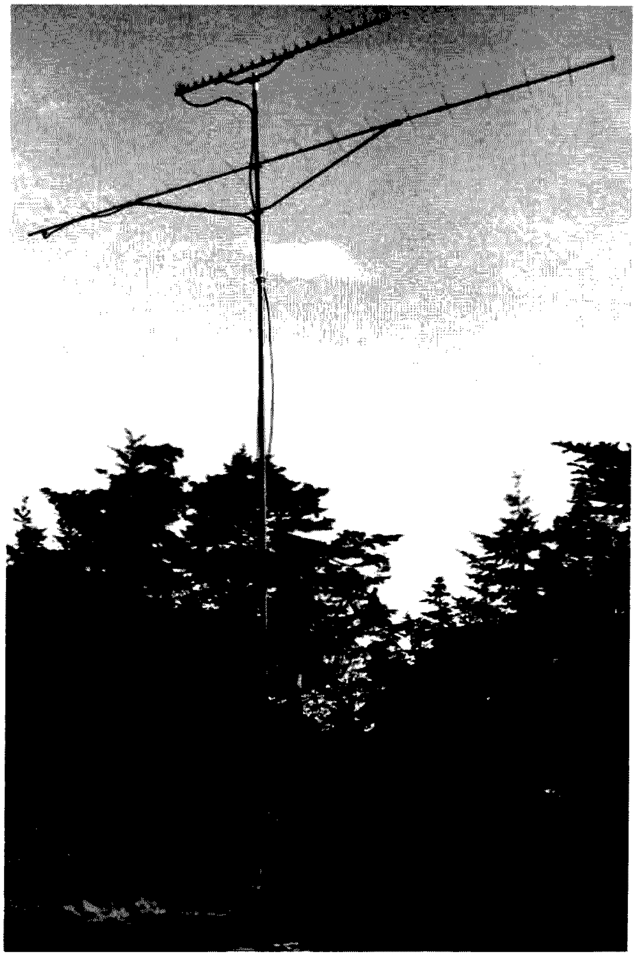


Photo C. The antennas. The mast was rotated using the time-honored "Armstrong" method.

Photo B shows me operating in my "warm" outfit (yes, I could hear the headphones through that wool cap) and Photo C shows the mast which was rotated by hand. What the heck, it was faster than a Ham-M! On and on we went, swinging the beam in all directions. What amazing signals! Jerry K2JWE, who had lent us the mast, was our first contact and he didn't take too kindly to our suggestion of leaving it up there when we came back down! As the evening wore on, the temperature dropped to about 45°, but the skies were crystal clear. An amateur astronomer would have a ball on Slide Mountain with a good telescope. The ranger set up his tent and spent the next hour watching and listening to us working stations, exchanging grids, calling out beam headings, setting up skeds, and operating CW, the latter which he found fascinating.

The QSOs kept coming, although somewhat slower now as the bands died down.

Photo D. WB2WIK on Sunday morning on 432 MHz. The ledge in the rock conveniently holds a paddle and the log. The 1296 station is on the right.

We didn't know that 6 meters had been open all day to the Midwest and South, which kept a lot of stations off the UHF bands. This probably also explains why we didn't hear any stations from Buffalo and Rochester and worked just one from Ottawa. Where was Toronto?

About midnight we decided to pack it in since the bands had pretty much been milked dry. Many stations were excited to work us on 432 and others were ecstatic to have finally bagged FN22 on 1296. My last few contacts, including K1PXE, N2BJ, and WA2FGK, were made from *inside* the sleeping bag with paddle and mike. At this point, we had worked 46 stations and 11 grid squares on 432 MHz, and 15 stations and 7 grid squares on 1296. Impressive totals for 4 hours of work with 10 Watts. We decided to hit the sack and get up early to make a few more contacts. But the porcupines had other ideas.

I spent the better part of the night chasing porcupines away from our site, for these ornery little devils like to chew on anything, and I mean *anything* they can get their teeth into. At various times throughout the night, they tried to chew on the 9913 cable, my gloves, the transverter, a flashlight, Steve's bag, the batteries, and our canteen. The best method to repulse them was a large stone thrown at their backsides. But as soon as I fell asleep, they returned and lit into something else. About 4:30 am I found out that "something else" was the nylon webbing on Steve's backpack, which had been nearly chewed through! A few large boulders chased them off again (there were at least seven or eight around us at all times) and by then the sun was starting to come up, so I gave up thoughts of getting any sleep. The ranger came by about 4:45 and we talked for a short while about the various methods used to chase off the porcupines, including the heavy-rock method, which he heartily endorsed. He claimed he had seen one eat through a tin can and swallow it, which I didn't doubt for a minute considering what damage had been done to the backpacks.

Steve had completely zipped up his bag in a mummy position and rolled off the rock into the trees, but the conversation and sunlight soon woke him up and we watched a truly beautiful sunrise. Breakfast was in order, and out came the thermos of hot chocolate and soup. Today's special was peanut butter and jelly sandwiches with (you guessed it) trail mix. The bags were rolled up and by 6:20 am we were back on the air. Photo D shows Steve hard at work making contacts on 432, and he looks like he just sat on one of the visitors from the night before.

The contacts came slowly but picked up after about a half hour. We were able to work another 14 stations and 2 new grids in 2 hours on 432, while 1296 yielded 4 new stations but no new grids. We finally worked a VE (VE3FN) on 432 and got into FM19 in Maryland and Virginia. But the low clouds from the day before persisted, leading us once again to think that moisture absorption was working against us.

Finally, at about 8:30 local time, we decided to start packing up and head down the mountain. Our decision was aided by an invasion of the largest swarm of black flies I've seen on a mountain. Out came the Cutters! The flies clustered on our damp clothes which were hanging on a guy rope, and hitting the clothes with a rock caused a black cloud to rise into the air. The ranger stopped by to say good-bye and headed down the mountain. It actually took us from 8:30 till 10:00 am to get ready to head out. Perhaps this was because we didn't relish the thought of having to carry all that weight again. Using up some of the food helped, as did emptying the thermos, but the bulk of the weight was still there—in the batteries, the multimode radios, the flashlights, and those blasted mast sections. It didn't look like an easy descent.

We were pleasantly surprised to see how easy it was going down. After all, gravity and Mother Nature were on our side this time and Murphy was nowhere to be found! We were able to cover the 2.7 miles down in just over 2 hours, *half* the time it took us to get up to the top. We arrived at the car at 12:15 pm and I was surprised when I opened it to find another canteen full of *cold* water. Shower time! Steve had fallen back a bit but appeared from the woods about 10 minutes later, got to the car, and toppled majestically onto the tailgate (pack and all) with the words *"Never again!"* After a short repacking period to secure the batteries so they wouldn't spill, we headed back to civilization and a lunch of hamburgers, hot dogs, onion rings, and *beer*.

In retrospect, I'd have to call the DXpedition a success, since we *did* achieve our objective, which was to operate from the top. We were both disappointed that there wasn't more activity that we could hear on the UHF bands (and I'm sure the 6-meter propagation caused a lot of that), but it was impressive to call CQs on 1296 and work stations with beam headings 90° away. Try *that* from your home sometime on the UHF and microwave bands! Our injuries were minor: Steve's shoulders and neck required some TLC and I suffered a mild burn from the back strap on my shoulder blade, which some lotion took care of. All the equipment made it back in one piece, although the 1296 antenna broke two elements on the climb down and the 432 antenna bent a few.

Would we do it again? Maybe, although with *more* help since it is a real *climb* when you're loaded down. But it's kind of a nice feeling to realize that you've set a goal for yourself, something that no one else has done, and carried it off. That's what makes ham radio exciting for me. As for Steve? He summed it up at the 3500-foot level on our way up Saturday: "Just leave me here to die."■

Luis E. Suarez OA4KO/YV5
Apartado 66994
Caracas 1061-A
Venezuela

Toss Out Your Tubes!

Replace them with high-performance FETs—OA4KO shows you how.

The purpose of this article is to encourage amateurs to modify all of those vacuum-tube accessories getting dusty in the basement. The general rules recommended here apply very well to any stage using vacuum-tube triodes or pentodes as oscillators or amplifiers. They can be replaced by unijunction FETs almost without circuit modifications. As a bonus you get lower power consumption with better gain, noise-figure, and intermodulation specs. A little bit of theory is explained and an actual modification is described.

This article began back in 1959 in Peru when, one day, I received TV Channel 2 from Cuba and Venezuela. That was the best year for propagation conditions I have ever seen! If Channel 2 was so well received on a normal TV set with an indoor antenna (there was no Channel 2 in Lima at that time), then I supposed that the 6-meter band would be a good choice for DX, too. However, my Novice license kept me out of that band until the early Sixties.

During those days, the most modern transmitter tube available was the 6146, a good tube up to 60 MHz. There were very reliable triodes for VHF receivers, most developed for television sets and featuring a very low noise figure and high transconductance. Many war-surplus goods for VHF were available, too, at very reasonable prices. I talked with experienced fellow amateurs and decided to make a visit to my local radio shop just to see what was available. The visit was discouraging. The best choices were a Globe Scout for a transmitter and the Hallicrafters S-40 for a receiver, but the goods were out of my price range. Fortunately, we were in the "build-it-yourself" days!

The Globe Scout was priced at $119.95 wired, and $99.95 as a kit. This transmitter, marketed by World Radio Laboratories, featured 80-to-6-meter coverage, AM plate modulation, crystallized frequency control, 5 tubes (including the new 6146), and a self-contained power supply. If desired, a 6-meter vfo, at $49.95, was available as an accessory, as was a vfo for the HF bands. It furnished a full 65 Watts CW and 50 Watts phone. I still have the brochure I picked up which has the schematic in the back, as was usual with all Globe products. I remember also the Globe Champion, a *deluxe* transmitter owned by my friend Jose Maria OA4II. This beautiful 300-Watt transmitter was well beyond my price range.

I went back home to digest the information I had gotten at the store. My own transmitter, the Globe Chief, had two 807s for 90-Watt CW and had a screen-grid modulator to go AM. The modulator and vfo were homemade and really worked! I also remember that I built another vfo for Eduardo OA4JR. The 807s allow no operation at 50 MHz, so the Globe Chief was discarded as a candidate for modification. My receiver, a used Hallicrafters S-40, had no 6-meter band

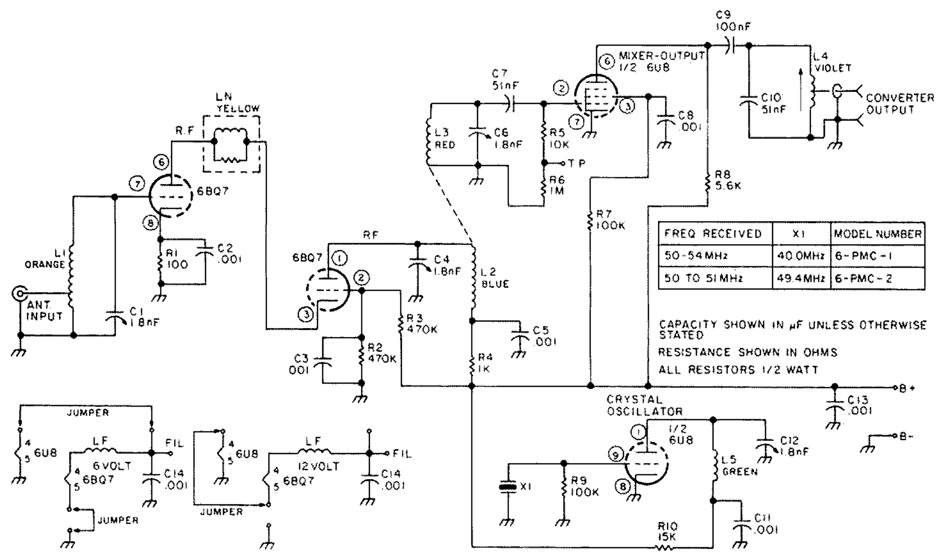


Fig. 1. The original two-tube 6-meter converter.

and the price of the new Hallicrafters S-53A, which covered up to 54 MHz, was prohibitive.

I decided to build a transmitter around the new 6146 tube and to swap a BC348 surplus HF receiver for another surplus VHF receiver. A couple of days later, I met Mark Johnson, the owner of the radio shop, a great man and better friend. He now lives retired in the US but is not a ham any more, for he was not well disposed to learning the code. We talked about my research and he suggested that I buy a converter for my receiver and that I construct the transmitter. That same night we went to the shop and he showed me the converter. It also was a World Radio Laboratories product, the model 6-PMC, and featured two modern tubes—the 6BQ7 (twin triode) and 6U8 (triode/pentode). I hurried home with the converter, connected it to my receiver, and received nothing but noise. An antenna was needed! I cut a dipole and called a friend on forty to run a test. I transmitted on 40 and received on 6 meters—and was treated to the clearest signal I had ever heard in my short life as an amateur. No QSB, no noise, no whistles, just pure AM! I soon had a three-element homemade antenna up, fed by my homemade transmitter, and certainly had the most enjoyable experience in my career as a ham.

Then came SSB, and soon propagation declined. I moved to Brazil and the converter remained on a shelf. Years later, all of my DXing was done on the HF bands using my Heath SB line. Even then, I thought that the converter was a good piece of equipment deserving a revamping. During the late Sixties I always had the intention of modifying it but never did until now.

WRL's 6-PMC

The 6-PMC is a tubed converter developed to be used

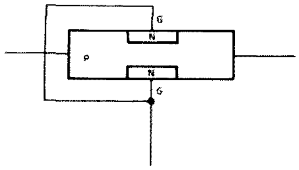


Fig. 2. Construction of a P-channel FET.

with any one of three different i-f frequencies: broadcast band, 10 MHz, or 28 MHz. The unit requires 200 V dc at 15 mA and 12.6 V ac at 850 mA. The antenna input connector is an automobile antenna type, since the equipment was intended to provide both mobile and fixed-station operation. The output is just a piece of coax to be attached to the antenna terminals of the receiver. The modern design (at the time) was developed around a phenolic printed circuit board and mounted in a gray painted aluminum box.

The schematic of the original converter is shown in Fig. 1. As you can see, the circuit is very simple. It has a cascode amplifier, a pentode mixer, and a triode crystal oscillator. The oscillator injection is provided by means of the stray capacitances. This scheme provided a low-noise/high-gain combination with very low intermodulation products. The only problem encountered was that the PCB warped due to the high temperature of the shielded tubes! The tubes were placed with half of their body inside the metal box, hence most of the dissipated heat remained within the enclosure.

What is a FET?

When I decided to modify this unit, the obvious choice was to replace the tubes with FETs. They work very well in place of the triodes and pentodes when used as class-A amplifiers, but they cannot be used as class-B or class-C amps, as will be explained later. The input impedance of a FET is very high, some 10 megohms. It

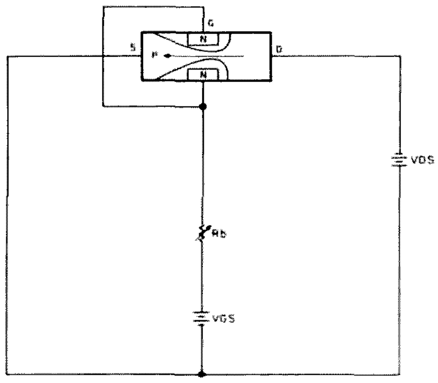


Fig. 3. Current flow in a properly biased P-channel FET.

has very low noise, very high gain and excellent intermod response.

The replacement of tubes by FETs is very easy to accomplish, but I prefer to review some basics just to have a background that allows you to attempt the modification of simple tubed equipment. This way you will know how it is done and what to do if your equipment is not the Globe converter.

Some Theory

A field-effect transistor, or a FET, is a very simple semiconductor device. It's much simpler than a bipolar transistor since it is just a bar of silicon with a dopant which determines its polarity characteristic. The bar, for example, is of P-type silicon and is shown in Fig. 2. One end of the bar is called the source (S) and the other end is called the drain (D). Midway across the bar there are two small N-type regions which are connected together and are called the gate (G). The portion of the silicon bar between the heavily-doped gate is called the channel. As the bar is of P-type silicon, our FET is called *P-channel*. Should the bar be of N-type silicon, the FET is an *N-channel* device.

As shown in Fig. 3, the current in a P-channel FET flows from the drain to the source through the length of the channel. Right at the junction, a subtle change has taken place—some of the

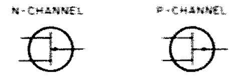


Fig. 4. Schematic symbols for FETs.

free electrons in the channel have filled some of the holes in the P regions. Therefore, right at the junction, there is a symmetrical crystal structure which forms a barrier and prevents any further combinations of holes and electrons. On either side of the junction, there is a small area without free carriers called the depletion region.

For proper operation, the gate should always be reverse-biased when referenced to the source. The source and the drain are interchangeable in most units if, and only if, the internal geometry is symmetrical. To stay on the safe side, follow the terminal markings and the manufacturer's recommendation. If the FET is a P-channel type, the drain must be connected to the negative side of the power supply and the gate must be positively biased. From a different perspective, the proper polarity of the drain can be determined by thinking of the gate as being shorted to the source. The polarity of the drain should then reverse-bias the junction at the gate drain end. The polarity of the drain, with respect to the source, is then opposite to the polarity of the gate with respect to the source. As shown in Fig. 4, the P-type FET symbol

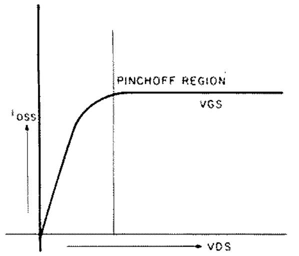


Fig. 5. Current flow as a function of supply voltage.

shows the arrow pointing away from the junction, while the symbol for an N-type has the arrow pointing toward the junction.

As you vary the gate potential, the current flow is also varied. The doping level of the gate is very large compared with the channel; therefore, when the p-n junction is reverse-biased, the depletion region will extend into the channel region. The current flows through the channel linearly as the supply voltage is increased until a pinch-off voltage is reached and the current cannot increase anymore (see Fig. 5). This is caused by the depletion region around the gate which reduces the channel to such an extent that no more current can flow through it. The depletion region has very few carriers, so its conductivity is very low. The result is a reduction of the channel cross section and hence an increase in the channel resistance.

Testing FETs

I_{DSS} is the current passing through the channel when the gate is biased at 0 volts or is just tied to the source. This current reflects the gain and the noise figure of the FET. The higher this current, the higher the gain and the lower the noise generated is. The setup to check the I_{DSS} is shown in Fig. 6. You should always use the drain-to-source voltage that will be used in the actual circuit. The gate is connected to the source and the current is read at the ammeter in series with the drain supply. Record this value for each FET that you have. I will show you later how to use I_{DSS} in an actual design.

FET Behavior

FETs are semiconductor devices and are affected by changes in temperature. The interesting thing is that an increase in temperature *decreases* the current flow—the reverse of a normal bipolar transistor. At the gate, the increase in temperature increases the gate-channel leakage, but this effect is only important when there is a very high resistance in the gate-to-source circuit. Normally, temperature is of no concern in the amateur service unless you install FETs in a very hot environment. In this particular case, temperature is something to be taken into account. However, most FETs will withstand temperatures of up to 150° C if they are properly biased.

Like vacuum tubes, FETs may be used as triodes in common-source, common-gate, and common-drain amplifiers, corresponding to common-cathode, common-grid, and cathode-follower tube configurations. Just replace the plate with the drain, the grid with the gate, and the cathode with the source. Most resistors and capacitors will remain the same value, with a few minor changes. However, it should be noted that the FET *cannot* replace a triode or pentode if the stage is a class-B or -C amplifier. The FET cannot drain current when the gate (grid) is forward-biased, as is normal for half the cycle in class-B or -C amplifiers.

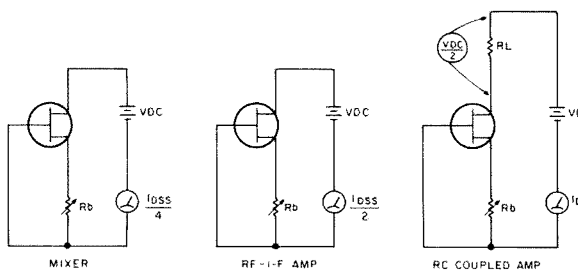


Fig. 6. Three FET circuits.

It is important to mention that the noise figure in a FET is quite lower than that of a bipolar transistor or tube. But remember that low noise figures are obtained only with careful circuit adjustment and proper selection of components. Noise is very important at both audio and VHF/UHF frequencies. At HF the high level of atmospheric noise is higher than the noise generated by FETs; however, a low-noise audio amplifier is an advantage in a communications receiver. In this regard, an outstanding combination is a FET product detector and a FET audio amplifier.

In general, any oscillator circuit designed around a triode may be used with a FET. A large gate-to-source resistor should be used to limit the gate current to a safe value, since a FET oscillator does not operate with gate current. When the gate goes forward biased it merely limits the drain-to-source current. Usually, this resistor is already installed in the tube circuit and may have a value near 100k Ohms. The signal amplitude may be controlled either by varying the supply voltage or by varying the source self-bias resistor (see Fig. 6).

As mixers and detectors, FETs are really excellent. Here is where the FET's low noise and freedom from cross modulation is of real value. The best operating point is achieved with a bias equal to half the pinch-off voltage. The drain current will then be 25% of I_{DSS} in static operation (without signal injection). Refer to your list of I_{DSS} values and reserve the units with higher I_{DSS} current for the amplifier stage. Use the second-better units for the mixer stage. Using the same setup as before, place a 10k pot in series with the source and adjust the resistance until the current drops to 25% of original I_{DSS} value (see Fig. 6).

For minimum cross modulation the instantaneous sum of the oscillator and signal voltages should not exceed the pinch-off voltage in low-level mixers with signals in the uV level. When signal levels are higher, like in a second mixer, the oscillator voltage should be reduced, which also reduces the conversion gain. There is a drawback, however: The interelectrode capacitance is very high in FETs and this may cause frequency pulling. The cure is to use an isolation stage.

For product detectors the oscillation injection should be reduced. A choke or high-impedance transformer is used at the drain output to ensure a higher voltage and hence higher current at the drain. The choke or transformer has less dc resistance than a resistor.

When the FET is used as an i-f or rf amplifier, bias the device at ½ I_{DSS}. Not too much gain is lost, mutual conductance is reduced by only 30%, and stability is ensured. The procedure is shown in Fig. 6.

For RC-coupled amplifiers, choose the load and select the bias to drop the voltage across load to half the supply voltage. Use the same setup shown in Fig. 6. The RL is the chosen load and a voltmeter reads the voltage across this resistor. Remember to use the units with higher I_{DSS} for high-gain preamplifiers to get a lower noise figure.

Throw Away Your Tubes!

My first step was to pull

out the tubes and shieldings in the old converter. Then I picked four 2N3819 FETs I already had. No special choice here, you may use MP-102s or whatever FET is at hand. Use a FET with high I_{DSS} current in the cascode amplifier for better performance. Always use the best FET at the first rf or audio amplifier, as I recommended before.

I replaced the tubes by plugging the FETs into the tube sockets, inserting a FET at pins 6, 7, and 8 of the first tube. Remember that tube pins are numbered from below—pin 1 is the first pin counterclockwise from the alignment gap (viewed from above). I plugged the remaining FETs into both tube sockets. Next, I connected the coaxial output to my Yaesu FRG-7700 antenna input and ran 12 V dc from my regulated power supply to the B+ cable in the converter. I tuned the receiver to 10 MHz and switched on the converter. The noise increased very little and I assumed nothing was wrong. A glance at the schematic and some voltage measurements showed very poor activity of the 40-MHz crystal oscillator. I pulled R10, the 15k resistor connected from the power supply to the plate (now the drain) of the 6U8 triode section, and replaced it with a jumper. I switched it on again and *listo*! TV Channel 2 interference was evident. I quickly tuned around 50.1 MHz but found no amateur activity. I tuned the TV-2 video carrier at 55.25 MHz. It was S9 + 10 dB. Some tweaking was necessary and after repeaking the i-f coil and adjusting the piston trimmers, the signal went up to S9 + 20 dB. I tuned in the TV-2 audio carrier at 59.75 MHz and placed my FRG-7700 in FM mode. The sound was crisp and the S-meter showed S9 after readjusting the trimmers. I moved back to 52 MHz and repeaked the trimmers. This time I received a

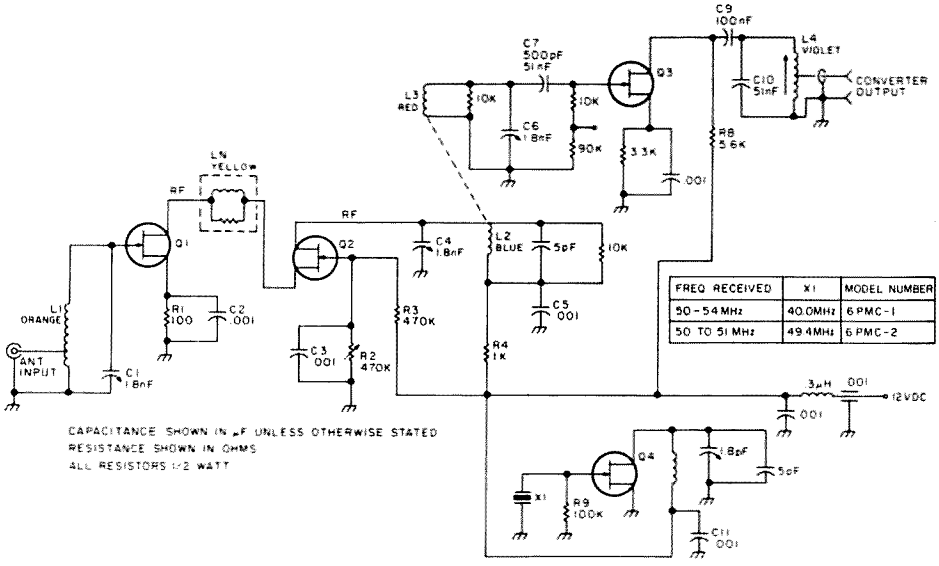


Fig. 7. The new four-FET 6-meter converter.

signal, although an undesired one: a pirate station! Well, it was not bad at all for a modification planned more than 20 years ago.

I desoldered the antenna connector, the coaxial output, and the supply cable. The next step was to remove the four screws securing the PCB by four bronze spacers. The automobile antenna connector was very ugly and hence was discarded. I installed a BNC jack in the same place and an RCA jack on the other side to be used as an output connector. Instead of the power-supply cable routed out of the box through a hole, I installed a 0.001-uF feedthrough to be used as the positive supply terminal and a #6 solder lug secured to the box with a 6-32 × ⅛" screw and nut for the negative supply connection. I also installed a 22-uF tantalum capacitor at the PCB B+ (now +12 V dc) hole and an 8-uH choke for rf filtering. You don't have a choke at hand? Don't worry, a 100-Ohm resistor may be used or just build a choke on a 1-Watt high-value resistor, winding as many turns as you can of number 28 enameled copper wire onto it.

Adjusting the coils while tuned to the TV-2 video carrier showed no improvement in signal strength. I tuned around 52 MHz and adjusted the trimmers for maximum noise. Coil L5 refused to tune even with C12 at maximum capacitance—same thing for C4 and C1. More surgery was necessary.

The two 470k resistors, R2 and R3, form a voltage divider that obviously results in a half-supply bias of around 6 volts. I decided to install a 470k trimmer instead of R2 to allow a bias adjustment. I replaced R6 with a 90k resistor and installed a 3.3k resistor in parallel with a .001-uF capacitor in series with the mixer source. For mixer operation, the FET gate bias should be equal to half the pinch-off voltage, which means a drop of some 25% in drain current. I installed also a 5-pF capacitor in parallel with all of the tuned circuits except output coil L4, which seemed to be resonant.

This time the result was better than I expected. Back to the TV-2 video carrier which, after retuning, showed a beautiful S9 + 40 dB on the Yaesu S-meter. The audio carrier was S9 + 20 dB and the sound was less distorted than before. This time the mixer worked very well. Back to 52 MHz, and the tuning capacitors peaked almost at their midway point. I removed the capacitor in parallel with C6 since it was not necessary. Then I adjusted the trimmer at R2 for best performance. Tuning across the band showed another pirate station, but no amateur activity.

At this time, I noted that capacitors C3 and C5 were improperly installed. Both were too far from the gate and coil, and as a result I noted a drop in gain each time I touched the connection with the voltmeter. I relocated them close to the gate and close to L2. Also, I moved C11 closer to L5 and replaced C7 with a 500-pF capacitor, removing the previously-installed 5-pF capacitor in parallel with C6 and C1. This time the TV-2 video carrier signal rose to S9 + 60 dB—full scale! The test at 52 MHz showed an oscillation due to the tremendous gain of the cascode amplifier. I cured the oscillation with a 10k resistor across both L2 and L3. This resulted in lowering the Q of both circuits and a flatter response across the six-meter band was achieved.

The last step was to remove the filament jumpers and to ground the unused lines. I removed also C14, C8,

and R7. Then I installed the PCB in the box and wired the BNC connector, the output connector, and the +12-V-dc feedthrough. A final retuning with the enclosure on and a test showed the oscillator was 2 kHz too low in frequency. The cure was to install a small coil with a ferrite core in series with the crystal. A small adjustment of the core moved the frequency 2 kHz up. The modified circuit is shown in Fig. 7. Please note that the inductance in series with the crystal is not shown in the schematic. Another crystal may oscillate higher in frequency and the cure in this case is a capacitor in parallel instead of a coil in series with the crystal.

I found no amateur-radio activity on 6 meters in Caracas. Most hams here live in apartments, and their installations are prone to TVI from 6-meter transmitters due to poorly-designed TV receivers. I couldn't test the converter with a real off-the-air signal, so it was off to the laboratory. At the lab, I tuned the converter using the Sinad method and two Cushman CE6-A communications monitors, one used as a tuned i-f and the other as a signal generator. All of the tuned circuits were resonant at the midway point of the trimmer pistons. Power drain was 15 mA at 14 V dc—just 210 mW instead of 10 Watts using tubes!

One final bit of advice. You can use tetrode FETs in the same way as triodes, but properly bias the second gate or just tie both gates together and use it as a unijunction FET for a simpler circuit. I am very satisfied with the results of this modification and I hope that this guidance will be useful to all those fellow amateurs wishing to modify their old tubed gear gathering dust in the basement. Now, regarding the 33 tube sections in the KWM-2. . .■

James E. Taylor W2OZH
1257 Wild Flower Drive
Webster NY 14580

Improve Your Audio Report

Are you tired of lying to your fellow amateur? Try the QRI signal reporting system. Let him know what he really sounds like.

Historically, the reporting of the audio quality of voice transmissions has been confined to readability and strength, to simply: Can you hear me? and, Am I strong? However, recent articles[1] and products[2] indicate an increasing awareness that this is not enough—many people want to hear the "personality" in the voice. There is evidence that readability is indeed enhanced by improved audio *"quality."*

What is this ephemeral entity which we call audio quality? Can it be measured in terms which are more meaningful than the conventional good, average, or lousy? In the paragraphs which follow I shall attempt to answer these questions and to suggest a reporting system which may prove of practical value for the growing number of hams who are interested in audio quality.

Frequency Range

The most fundamental attribute of the human voice is the frequency range. As will be pointed out later, there are other characteristics which are significant, but from the standpoint of intelligibility the frequency range of the voice and the frequency response of the ear are of salient importance. The plots which follow[3] give us a quantitative basis for frequency comparisons.

Fig. 1 shows spectra for typical "voiced" vowel sounds. Here we note that for the sounds "oo" and "oh" the most prominent frequencies are the third and fifth harmonics, respectively, although the fundamentals are identical. For the sound "ee," however, there are important harmonic frequencies as high as 4300 Hertz. The "unvoiced," or breath, sounds (for example, "sss") can be even higher in frequency.

Fig. 2 indicates the envelope of frequencies for a typical sampling of male voices. (Incidentally, because of their wide variety of speech sounds, the words used for this plot were "Joe took father's shoe bench out; she was waiting at my lawn." At least it's better than "Hello, test"!) Since this is a plot of sound *pressure*, a factor of two means six decibels. The average (the solid line) is seen to be relatively flat up to about 1000 Hertz and then to decline gradually with the 6-dB point at 3500 Hertz.

Fig. 3 indicates typical response curves of the human ear. Curve 1 is for a single ear; Curves 2 and 3 are for both ears—with multiple and single sources, respectively. Curve 3 is the typical ham situation, a single speaker in front of the listener. Here, we see that the maximum sensitivity of the ear is at about 3500 Hertz. Also, we note that this plot is directly in decibels, so the ear is much more peaked than the voice; there is an almost 30-dB variation from low frequencies to the fre-

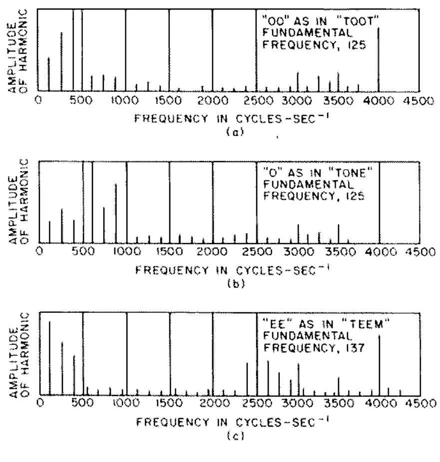


Fig. 1. Frequency components in intoned vowel sounds.

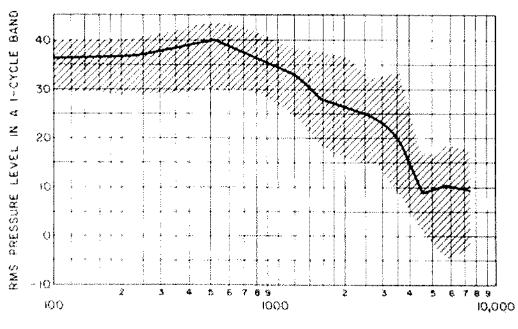


Fig. 2. Pressure vs. frequency, typical male voice.

quency of maximum sensitivity!

Now, what have we learned from all of this? Well, quite a lot! We've seen that the voice frequency spectrum above 2500 Hertz is rich in harmonics of the low tones in the typical voice and also in the sibilant sounds. Also, we have seen that the ear is relatively insensitive to the lower audio frequencies. Therefore, any reporting system for audio quality which we devise should give primary attention to both the highs and the lows, as well as to the mid-range audio.

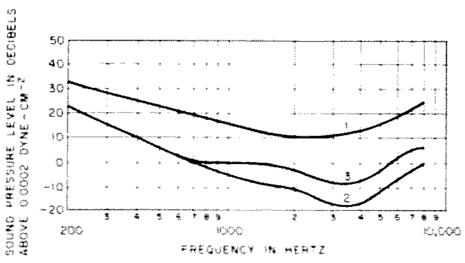


Fig. 3. Typical thresholds of audibility.

Dynamic Range

For our purposes, the term "dynamic range" will include two connotations: (a) the ratio of significant speech-sound amplitudes and (b) the ratio of desired signal to undesired distortion products.

Referring to the first meaning, the dynamic range of voice is just the ratio of the strongest vowel sounds to the weakest or "unvoiced" sounds. Typically, this will exceed twenty decibels for voice. (For comparison, music can exceed thirty decibels.) Dynamic range is a natural and desirable voice characteristic which adds significantly to the comfort of conversational speech. The so-called speech processors in all-too-common use today have the questionable function of enhancing the weak syllables of speech sounds, thereby acting to destroy the natural dynamic range. In all considerations of audio quality for amateur radio, the key word is "comfort." After all, we are dealing with a hobby.

Referring to the second connotation, P. E. Chadwick stated in a recent article that ". . .the term, dynamic range, now means all things to all men, and almost any meaning desired can be attributed to it!"[4] Accordingly, I will include in "dynamic range" the ratio of maximum-desired transmitter-power output to the corresponding unwanted or intermodulation-distortion output. Thus, for single-sideband transmission, the ratio of wanted sideband to the unwanted sideband would be included in the dynamic range—typically in excess of 40 dB for transmitters of modern design.

Audible Artifacts

In addition to the above categories of attributes which contribute, either positively or negatively, to the comfortable transmission and reception of amateur voice signals, there has to be a "catch-all" classification which covers "none of the above." I have chosen to call this *Audible Artifacts*. Here, we find a range of extraneous audible distractions ranging from slightly annoying or fatiguing sounds to major anomalies in the signal which can mask or interrupt reception. These include audible distortion, sounds due to switching or handling of the microphone, breath sounds due to exhaled syllables spoken directly into the mike, and background noise from fans, chairs, kids, etc. Also included in this category would be a number of electrically-generated artifacts such as hum, rf feedback, and oscillations of various types.

Now that we have provided an elementary basis for classification of the principal contributors to or detractors from good audio quality, let us consider how one might generate a meaningful voice reporting system.

Reporting

In the above paragraphs I have pointed out that a simplified reporting of the technical quality of voice transmissions should consider five attributes:

Low-Frequency Response
Mid-Frequency Response
High-Frequency Response
Dynamic Range
Audible Artifacts

If we arbitrarily decide that we wish to give an equal weight of 2 points to each of these attributes, we have a neat system for reporting quality on a scale of one to ten! Also, if we consult the ancient Q signals which go back to the early days of CW reporting, we find that the signal, QRI, refers to tone—originally reported on three levels. Let us assume that voice is enough more complicated that we need five levels for reporting rather than three, and presto, our system is clear! QRI = 10 means a breakdown of 22222; I haven't heard many on the ham bands recently who rate such a report!

Now, how do we use this reporting tool on the air? First, we must switch the selectivity of the receiver to the widest passband available (lowest selectivity). After all, you can't report on highs if the receiver doesn't pass the highs. (For example, I found that my receiver was so deficient in low-frequency response that I have substituted a miniature solid-state hi-fi amplifier for the one originally there, and guess what! I've never found a receiving situation where it helps to switch back to the original amplifier!)

Once we have determined that our receiver is capable of reproducing "good" audio it's fun to tune in a voice signal and "give it the works"!

If we are to give a reproducible quality report, we must apply the same standards to all signals. To ensure this it may be helpful to form, mentally, a set of questions relative to our five categories of reporting. For example, begin with a familiar voice:

A. Low-Frequency Response

Are the bass or low vowel sounds faithfully reproduced? Does the bass sound smooth and well-rounded, not nasal? Do you feel tempted to retune to try and improve lows? Assign 2 if the lows are excellent, 0 or 1 if not.

B. Mid-Frequencies

Do the tenor or treble tones sound smooth, not peaked? Do these tones appear to join comfortably to the lows? Are the subtle inflections of the voice rendered well? Assign 2 if the mid-range is excellent, 0 or 1 if not.

C. High-Frequency Response

Are the s-sounds (sibilants) whistling naturally? Do high-pitched voices sound natural or distorted? Are the sh-sounds clearly different from the s-sounds? Assign 2 if the highs are excellent, 0 or 1 if not.

D. Dynamic Range

Are the strong syllables (vowel sounds) strong? Speech processors often make the breath sounds really rancid! Now, tune to the unwanted sideband. (If you are using the lower sideband, the upper is the unwanted sideband.) Is there any voice audible here? The unwanted should be weaker than the wanted by at least 40 decibels. Assign 2 if the dynamic range is excellent, 0 or 1 if not.

E. Audible Artifacts

Tune back to the wanted

sideband and listen critically to the voice. Do you hear any distortion, ac hum, background noise, or anything else which shouldn't be there? Tune off either side of the signal—is there any carrier, splatter, or other abnormal broadening of the signal? Assign 2 if no artifacts are present, 0 or 1, otherwise.

Having carefully evaluated the signal, we are now ready to give the QRI report. The report is just the sum of the five numbers assigned above—a TEN is perfection (just like in the Bo Derek movie of the same name). Less than ten needs some explanation. For this it may be helpful to give the five numbers in sequence as, for example, QRI:8 = 12122 would mean a clean signal which is somewhat deficient in lows and highs.

Conclusion

This brief article is an attempt to provide a system of reporting, numerically, the audio quality of radiotelephone signals. A Q signal which has fallen into disuse, QRI has been resurrected to help in the process. It is hoped that this suggestion will lead hams to insist upon improved voices in their loudspeakers! ■

References

1. Richard L. Measures, "Better-Sounding SSB," *Ham Radio*, February, 1984, and see p. 65, same issue, "Ancient Modulation."
Daniel Peters, "Microphone Calibration," *Ham Radio*, June, 1984.
Cornelio Nouel, "Build Your Own Microphone Equalizer," *CQ*, July, 1984.
2. "HM-5 Microphone," *QST*, April, 1984.
3. *An Introduction to Acoustics*, Robert H. Randall, Addison-Wesley Press; Cambridge, Massachusetts.
4. "Dynamic Range, Intermodulation and Phase Noise," P. E. Chadwick, *Radio Communication*.

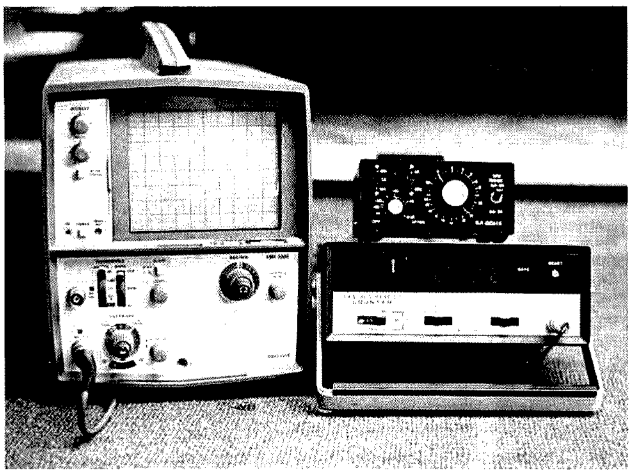
Rick Littlefield K1BQT
Box 114
Barrington NH 03825

Conjure an Rf-Genie

73's Weekend Special: A 3–22-MHz signal generator/ i-f aligner you can build in under two hours.

A good signal generator is essential for anyone who builds or rejuvenates ham-radio equipment. However, new generators can be extremely expensive—and older surplus units can be large and unwieldy. If your needs are modest and your bench space limited, why not roll your own?

The "Rf-Genie" is a compact home-brew generator covering most popular HF and i-f frequencies. A variable oscillator covers 3.2 to 22 MHz in two bands—providing coverage of 80 through 15 meters plus most crystal-filter frequencies. Optional 455-kHz and 10.7-MHz crystal oscillators can be switched on-line for precise i-f alignment. Generator output is on the order of 4 volts p-p into a 500-Ohm load. A simple voltage-divider attenuator controls the generator's output level, and a second output provides sufficient drive for an external frequency counter. The Genie is powered by a single 9-volt battery, and an LED indicates battery condition when the unit is turned on. Because the generator is self-contained in an aluminum box, rf leakage is very low.



The Genie in operation.

Circuit

Q3, 4, and 5 make up the oscillator and buffer stages of the variable-frequency module. This is a standard "handbook" vfo circuit which has been modified to cover a wide frequency range. The LC circuit consists of tapped toroidal inductor L1, dual-section capacitor C1, and a 3PDT miniature toggle switch. Oscillator stability is sufficient for most short-term alignment jobs. However, long-term stability could be improved by substituting a T50-6 core for the T50-2 core at L1 and by substituting a quality wafer switch at S1. For fixed values of C, NPO ceramic capacitors are more stable than silver mica.

Crystal oscillators Q1 and Q2 are adaptations of simple untuned bfo circuits. The 455-kHz module uses a ceramic resonator in place of a crystal. If a crystal is substituted, a much larger netting capacitor is required to produce sufficient trimming range.

Slide switches activate the desired oscillator. S2 switches between the variable and fixed oscillators, and S3 selects the fixed oscillator frequency. A single DP3T slide or rotary switch could replace S2 and S3 to provide a more straightforward switching arrangement.

The attenuator is a simple voltage divider controlling the oscillator output level. This provides a wide range of signal outputs for casual alignment work. For more critical applications, a step attenuator is a worthwhile addition (refer to pages 25–42 in the 1985 *ARRL Handbook* for a possible design). A second attenuator adjusts signal level to the frequency-counter output. This is set to the minimum level

Parts List

RFC1— 1 mH, Miller 70F103A1, Radiokit
RFC2— 10 mH, Miller 70F102A1, Radiokit
Y1— 10.7-MHz crystal, Type GP-1, Cat. #4331626, International Crystal Corp., $8.67 each
Y2— 455-kHz ceramic resonator, CSB-455E, Radio Shack
L1— 38 turns #28 on T50-2 (taps at 4, 10, and 17 turns)
C1— 15-90/15-200 pF with trimmers and vernier. BCD Electro, $2.50 each (p. 28, Cat. #73)

required for stable readout on the counter across the generator's range.

Zener D1 and LED D2 make up a simple off/on and battery-status indicator. When battery voltage falls below the voltage threshold established by the zener, the LED no longer illuminates. A 1k series resistor limits LED brightness in order to prolong battery life.

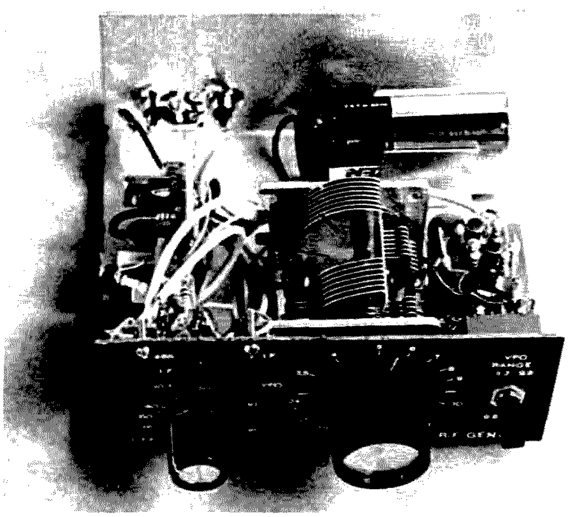
Construction

Since small size and simplicity were desirable for my application, I built the generator into a compact 2" X 4" X 4" case. To reduce the chance of leakage, all of the longer rf leads were shielded. Overall layout was not critical—but normal precautions were observed when assembling the vfo section. Vfo components were carefully secured to ensure mechanical stability, and the board was mounted as close to the bandswitch and tuning capacitor as possible. Leads to the bandswitch, tuning capacitor, and inductor were formed from stiff bus wire and kept short. The vfo inductor was mounted on the switch itself, held firmly in place by the mounting leads.

The tuning capacitor I chose is particularly well suited for a signal generator since it has two sections with different capacity ranges, built-in trimmers, and a reduction drive. It is available from BCD Electro for $2.25 and comes complete with a tuning knob and pointer. With a little experimentation and a different bandswitch, frequency coverage of the generator could easily be extended and spread out over several bands.

Calibration of the variable oscillator was accomplished with the aid of a frequency counter. Some manipulation of the trimmers on C1 was necessary to butt the beginning of the high-frequency band to the end of the low-frequency band. Once the ranges were established, the frequency scales were marked on the panel. I used Presstype dry transfer lettering—a painstaking exercise that took a couple of hours to complete. Although this gives a professional appearance to the completed unit, a paper scale marked in pencil or ink would be just as functional.

RG-176 miniature coax was used for test cables. One cable is terminated with miniature clip leads for connection to the circuit under test, and the other with a BNC connector for connection to a frequency counter.



Inside view of the Genie.

Operation

The Genie is very simple to use. When paired with a frequency counter, accuracy is a function of the counter's readout. Since the vfo is heavily buffered, the generator remains stable under varying loads. The only problem I have encountered is a function of the generator's wide frequency range. Setting the generator to a precise frequency on the 20- or 15-meter band becomes very touchy due to the lack of bandspread.

Conclusion

The "Rf-Genie" was designed to fill the performance gap between older "kit" generators and expensive lab-quality units. It provides stable coverage of the more popular HF ham bands and offers crystal-controlled accuracy on the two most common i-f frequencies. Many options can be added to suit the individual builder.■

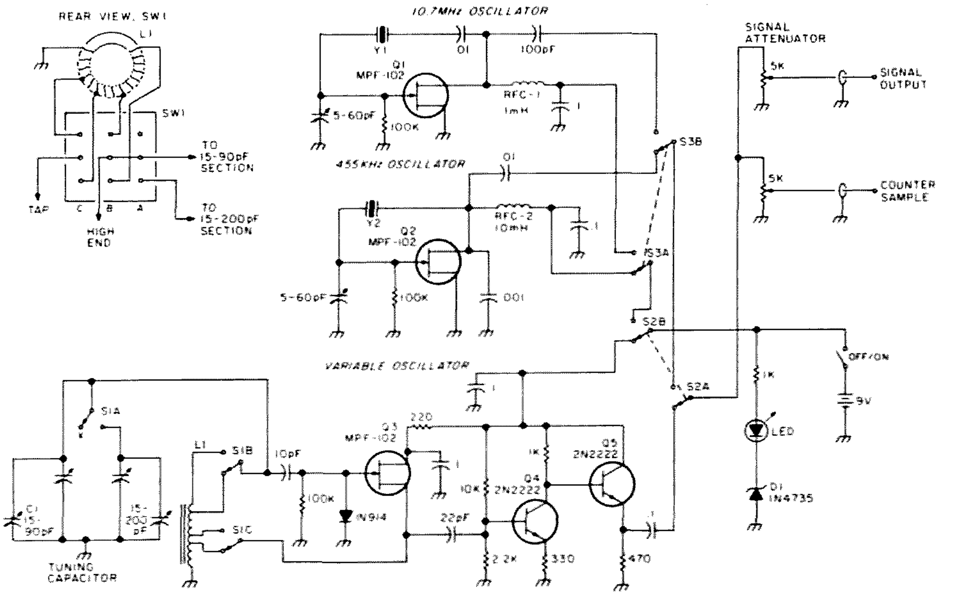


Fig. 1. Schematic for the "Rf-Genie."

John Reed W6IOJ
770 La Buena Tierra
Santa Barbara CA 93111

Operate OSCAR on 10 Meters?

It's a snap—all you need is this versatile satellite converter!

The transceive mode of operation is a worthwhile convenience—you're on that DX station without causing those QRM-type frequency-alignment tuning whistles. This 435-MHz transmit converter has an output of over 2 Watts, and the 146-MHz receive converter features a low-noise GaAsFET preamplifier. Most of the parts can be purchased from Radio Shack, and the others are readily available by mail order. I have included in this article descriptions of a test assembly for evaluating frequency spectrum and a simple dummy load/power-measuring device. No other special test equipment is required. The critical frequency-alignment measurements can be made using the HF transceiver calibration.

How It Works

Confirming access into the OSCAR-10 satellite requires simultaneous operation of the transmitter and receiver, complicating the HF transceiver conversion. The method of solving this problem is indicated in Fig. 1. Access is confirmed by switching to a test mode where a separate 29.6-MHz source activates the transmitter mixer while simultaneously the LO (local oscillator) frequency is lowered by 10 kHz. Without the frequency shift, the received satellite response would have the same frequency as that of the test source.

Misalignment of the transmit/receive frequencies caused by Doppler shift or minor equipment variances are compensated for by a receiver LO frequency-trim capability. Tuning the receiver to the frequency corresponding to the transmitter LO shift (29.660 kHz) and trimming the receiver LO adjustment while listening to the satellite response will result in transceive tracking.

It should be noted that satellite sideband reversal is accommodated with the transmitter mixer LO on the low side and the receiver mixer LO on the high side of the operating frequencies. In actual operation, and with my particular HF transceiver, I can hear the tail end of the satellite response as it is delayed from the long propagation path. Success of this feature requires a

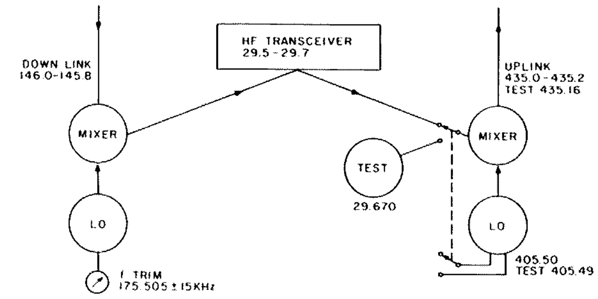
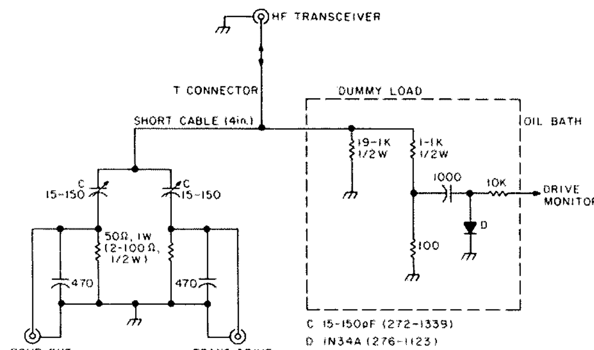


Fig. 1. Concept block diagram.



C 15-150pF (272-1339)
D 1N34A (276-1123)
OIL BATH-1 PINT PAINT CAN-COOKING OIL
RESISTORS 1/4W UNLESS OTHERWISE NOTED
CAPACITORS IN pF

Fig. 2. HF transceiver interface.

transmitter hold time of less than 200 ms. This type of cross-check for satellite access is useful but it is not a requirement.

Fabricated Methods

Etched lines are avoided in the UHF stripline circuitry by using a glue-down stripline technique. Strips are cut from double-sided glass PCB of the size normally associated with etched-circuitry dimensions. One side is smeared with glue and firmly pressed against the base PCB. No dc connection is required between the glue interface. Dc isolation is provided by filing a small groove in the stripline foil and soldering the related coupling capacitor across the groove. Tests indicate the performance to be equivalent to that of etched circuitry. Components other than striplines are mounted using small PC pads glued to the primary PCB, the parts soldered directly to the pad foil for interconnection and support. This fabrication method is exceptionally flexible. If a mistake is made, simply lift the stripline or mounting pad with a knife and make the necessary change.

HF Transceiver Interface

The HF transceiver is operated at the minimum power level that does not compromise its performance. Only 0.5 Watts is required for the converter, therefore most of the power is dissipated in a dummy load. The interface includes two capacitive variable attenuators, each adjustable from −10 to −30 dB. One is adjustable to provide optimum transmitter converter drive, and the second, used to protect the receiver converter from high rf levels, is normally operated at maximum attenuation. Their effect on load impedance is minimized by connecting them through a short 4-inch cable to a T-connector on the dummy load.

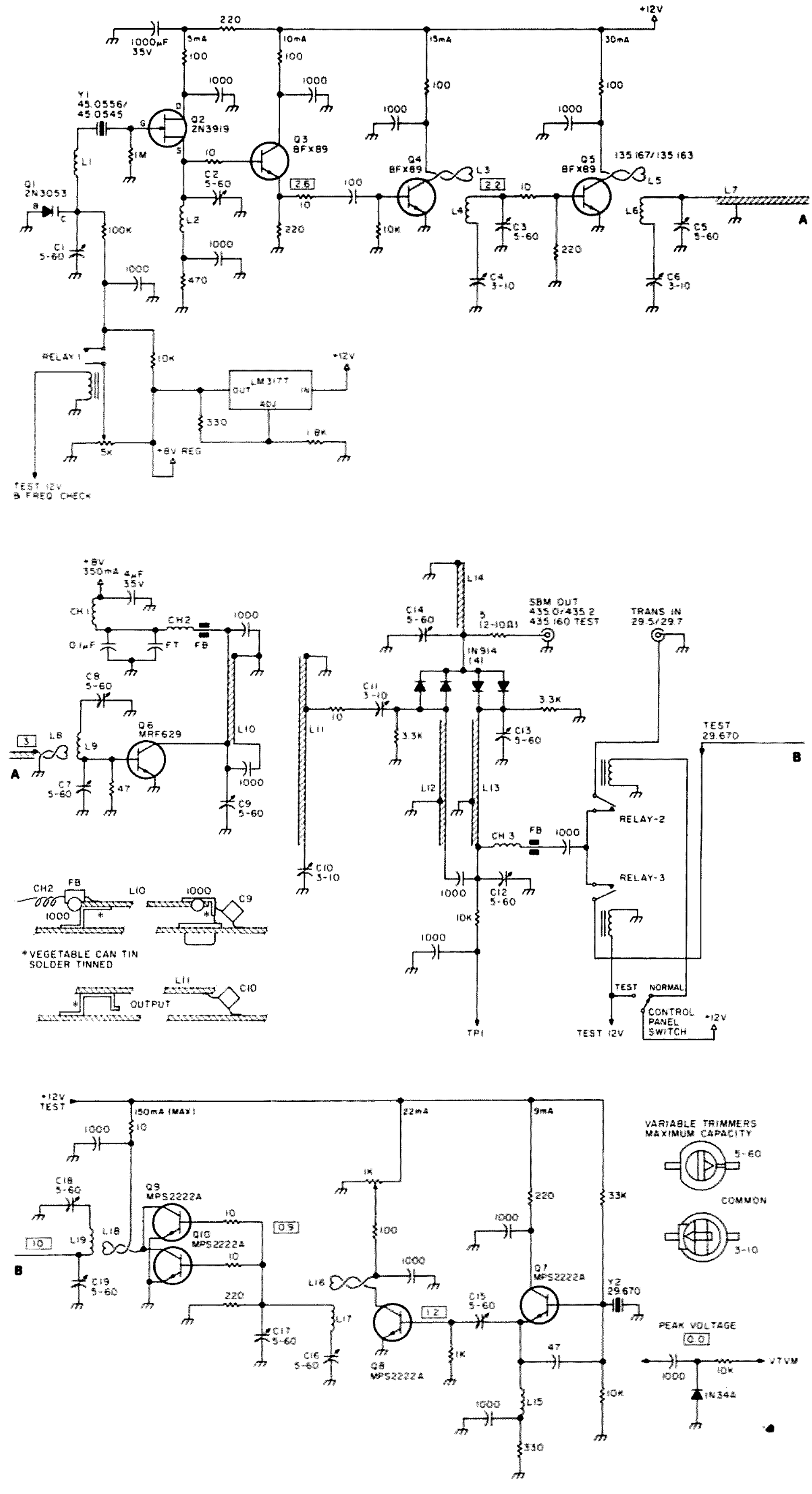


Fig. 3. Transmit converter.

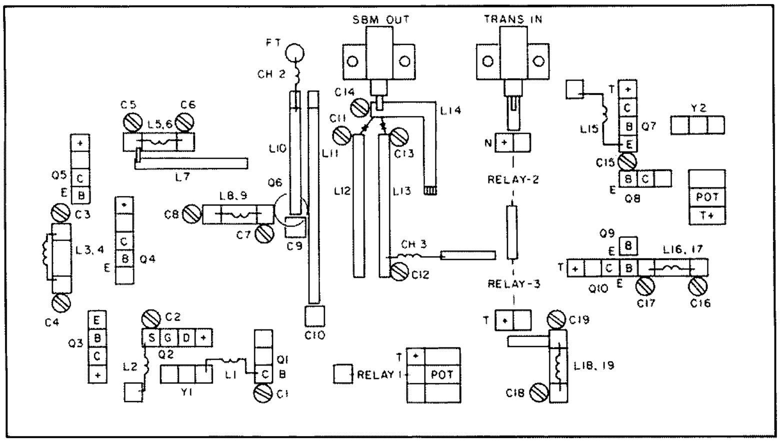


Fig. 4. Transmit converter layout indicating glue-down mounting-pad and stripline locations.

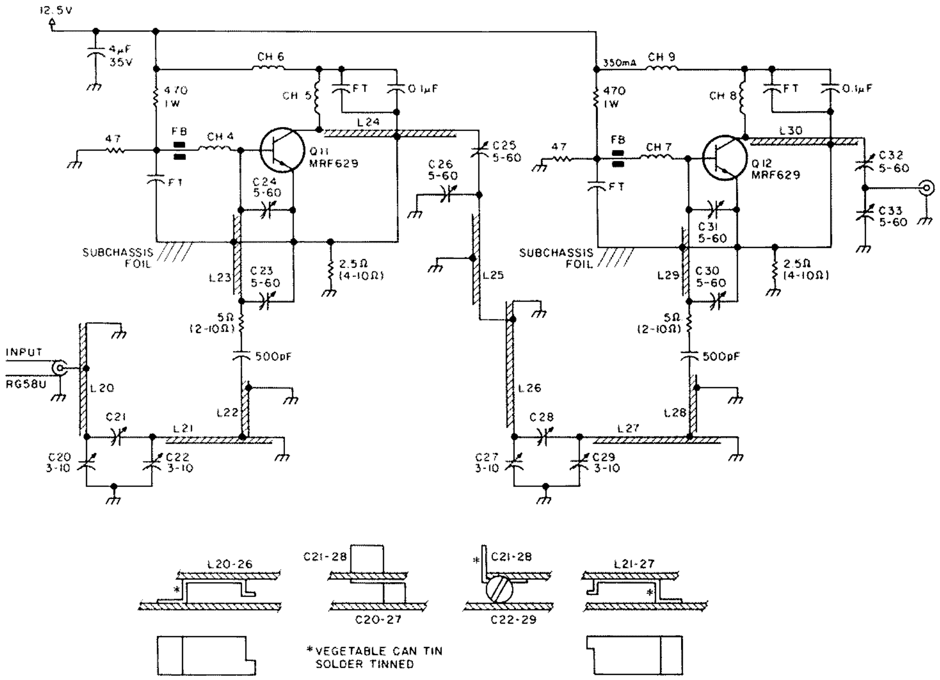


Fig. 5. Amplifier/filter circuit.

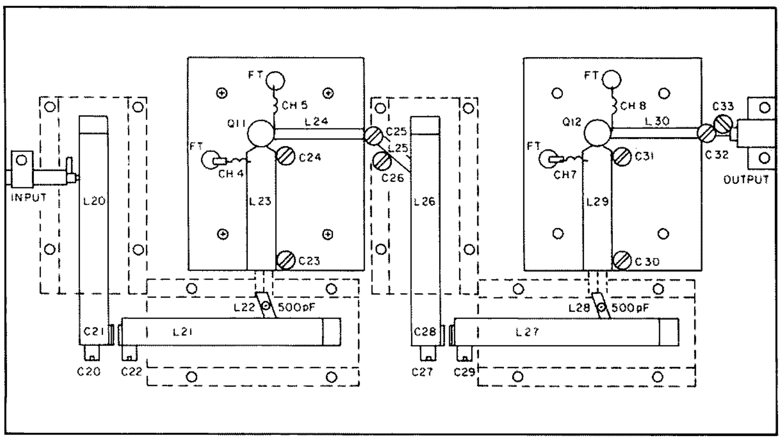


Fig. 6. Amplifier/filter layout.

The dummy load is twenty 1/2-Watt, 1k resistors connected in parallel. They are clustered around an RG-58/U cable, soldered to two 1-1/4″-diameter plates. The plates are parallel and spaced the length of the resistor. The complete assembly is immersed in a pint of cooking oil. The dummy load can absorb 100 Watts for short periods.

Transmit Converter

The transmit converter LO starts with a 45-MHz vxo (variable crystal oscillator). The normal operating frequency (45.0545 MHz) is established by the trim adjustment, C1, and the test frequency (45.0556 MHz) is trimmed by a 2N3053 connected to operate as a varactor. In the test mode, the varactor is switched by relay 1 to a 5k potentiometer for frequency trim.

The vxo is a very useful, stable, and reliable device. However, two precautions are required. First, it is very sensitive to common capacitance at the crystal inductance junction. Due to this, and to reduce stray capacitance, I have avoided using a standard crystal socket, making one using pins from an old miniature tube socket. Also, care has been taken to isolate the crystal from the mounting PCB.

Second, it likes a slow turn-on. This is accommodated in the circuit using a 220-Ohm, 1000-mF filter in series with the supply voltage. The vxo is followed by a buffer, tripler, and amplifier. The BFX89 was chosen for these stages due to its high performance and because it's available on the surplus market at low cost. The 135-MHz amplifier has an output of 150 mW.

The Q6 MRF629 used in the 405-MHz tripler has two unusual features. First, the emitter is tied to the TO-39 case, and soldering it to both sides of the double-sided mounting PCB provides adequate heat sink. Second, it

contains Faraday shield diodes between the collector and emitter for the purpose of isolating the base input from the collector.

When operating below the rated voltage, the diodes function as varactors; the transistor then operates as an effective frequency multiplier (Motorola EB70A). In the circuit, the third harmonic is picked off by a high-Q stripline, L11–C10, and inductively coupled to a second stripline, L10–C9, that is connected directly to the MRF629 collector. The output is over 0.5 Watts.

The 1N914 SBM (single-balanced mixer) uses parallel diodes to increase the power-handling capability. The 180° phase shift is handled by two 1/4-λ striplines, L12-L13. Phase-nulling trim is by C12, and amplitude-nulling trim is by C13. They can be adjusted to provide 40-dB rejection of the LO at the SBM output. However, under dynamic operating conditions as a mixer, the rejection is reduced to approximately 20 dB. The dominant output at the low-Q stripline, L14–C14, is approximately 100 mW at 435 MHz. Attenuation of the 376-MHz image is about 6 dB.

TP1 is an invaluable test point. It confirms proper SBM drive by the LO (10 V) and the LO + signal (13 V). The SBM signal is from either the HF transceiver or the test source as switched by relay 2 or relay 3.

The test source has a maximum output of 1 Watt at 29.6 MHz. In normal operation it is adjusted by a potentiometer in the driver supply voltage to about 0.5 Watts to the SBM.

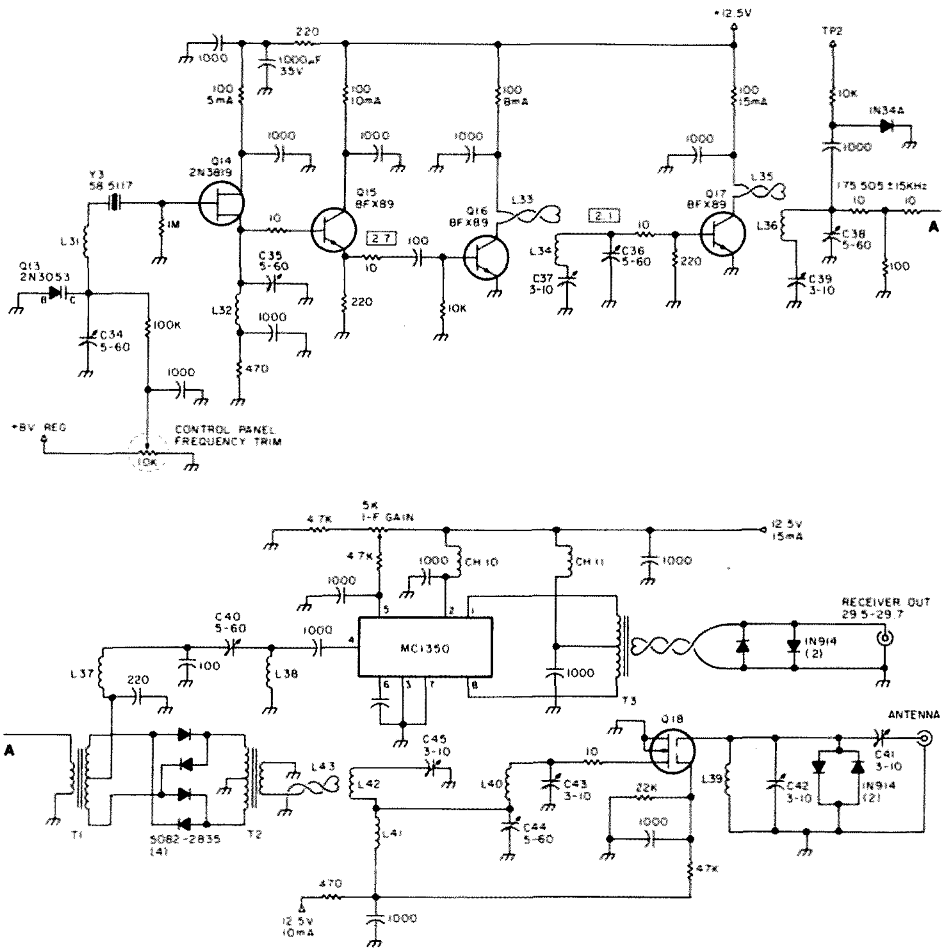


Fig. 7. Receive converter circuit.

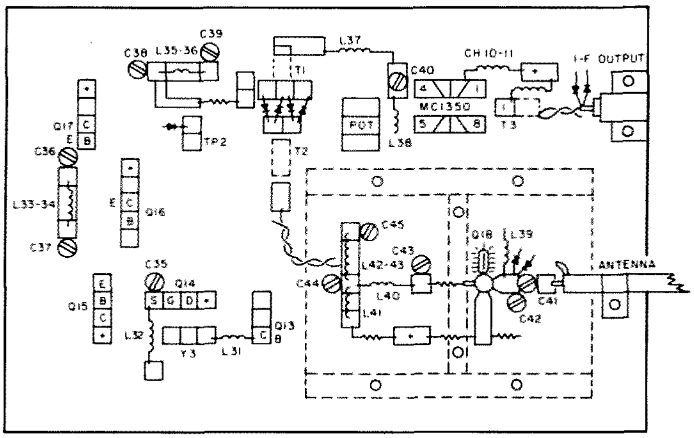


Fig. 8. Receive converter layout indicating mounting-pad locations.

Amplifier/Filter Assembly

A filter is required to discriminate against the SBM 405-MHz LO leakage and the 376-MHz image. There are actually two filters, each having two air-gap high-Q striplines. Each of the filters can be adjusted to provide 20-dB isolation of the 405-MHz LO while peaked at the 435-MHz operating frequency.

Image discrimination is much greater. The insertion loss of each filter is approximately 1 dB. The critical element of the filter is the home-built capacitor between the two striplines. It is adjusted for critical coupling between the two tuned circuits by bending the 5/16"-square plates for different capacity.

The capacitor plates and other mounting hardware associated with the striplines are made from vegetable-can tin, tinned with solder. The stripline shield size is 13/16" × 9/16" × 2-3/4". They are mounted leaving the stripline ends exposed to permit adjustment

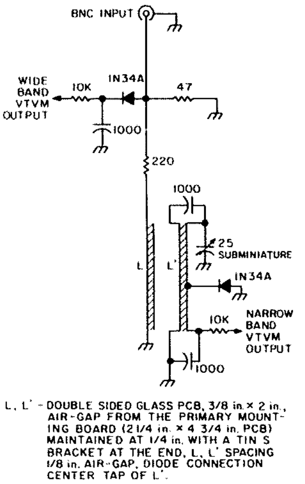


Fig. 9. Spectrum monitor.

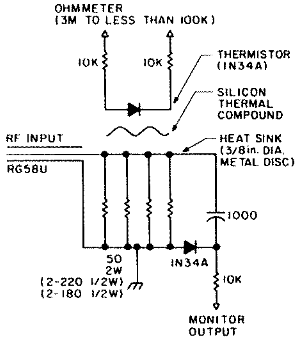


Fig. 10. UHF dummy load/power meter.

of the capacitors. The shields are made from Reynolds perforated aluminum (1/8-inch holes spaced 1/4 inch). Forming shields with this material is easy.

The MRF629 amplifiers are identical. Each is mounted on a 2-1/2″ × 3″ separate PC board for the purpose of isolating the emitter for biasing. The PCB is held to the base PCB with four 2-56 screws using a third 1/2-inch-square PCB at each screw to insulate the screw from the base board. The various foils are reamed with a large drill (1/4 inch) to keep the screw from shorting on the foil.

Insulation between the two boards is not critical—I used plastic from a sandwich bag. Adequate heat sink for the MRF629 is provided by soldering the TO-39 case to both sides of the PCB. The 2-1/2-Ohm emitter resistor is more than adequate for dc stabilization under all operating conditions. The bias resistors indicated make an idling current of approximately 100 mA. Although the MRF629 is rated at 8-dB gain, 9 or 10 is typical.

Receive Converter Assembly

The receive converter LO circuit is the same as that used in the transmit assembly. The crystal series inductance is somewhat more critical due to the larger frequency variance. Also, the varactor voltage is controlled by a potentiometer at the operator position rather than in the module.

The 175-MHz output of about 100 mW is more than enough for the DBM (double-balanced mixer). A 4-dB pad is used at that interface to ensure optimum termination. The diode-ring DBM provides excellent port-to-port isolation even when using ordinary unmatched diodes. Don't hesitate to make your own DBM—it's easy to build. Twisting the trifilar wires together before winding them on the toroidal core will minimize the chances of scraping the insulation.

The preamplifier dual-gate GaAsFET was purchased as a surplus MRF966. However, the assembly received is marked TI201/45-005 and it has different bias characteristics. Having no data sheet, I experimentally developed operating conditions I believed to be near

Transmit Converter Parts List

Q1—2N3053 (276-2030)
Q2—2N3819 (276-3035)
Q3, Q4, Q5—BFX89 (MHZ Electronics)
Q6—MRF629 (MHZ Electronics)
Q7, Q8, Q9, Q10—MPS2222A (276-2009)
LM317T—(276-1778)
1N914 diodes (4) (276-1122)
Y1—45.0556 MHz; Y2—29.670 MHz (ICM 031081)
5-60-pF trimmers (15) (272-1340)
3-10-pF trimmers (4) (272-1338)
FT—0.001-μF feedthrough capacitor (Meshna H30)
Relay 1, 2, 3 (275-233)
FB—ferrite bead (2) (Amidon FB-64-101)
Ch1—10 μH (273-101)
Ch2, 3—15T #30 wire on 1/2-W 1k resistor
L1—25T #26 wire on 1/4″-dia. Plexiglas form
L2—14T #22 wire on 1/4″-dia. Plexiglas form
L4, L6—6T #14 wire, 1/4″ inside diameter
L3, L5—3T #22 hookup wire wound around end of L4 and L6
L7—Interconnect glue-down stripline 1/8″ × 1-3/4″
L9—5T #14 wire, 1/4″ inside diameter
L8—1T #22 hookup wire wound around end of L9
L10—3/16″ × 1-1/2″ stripline, 1/4″ air-gap from mounting board
L11—3/16″ × 2-3/4″ stripline, 1/4″ air-gap from mounting board
Spaced 1/8″ air-gap from L10. Output tap 5/16″ from end.
L12, L13—Glue-down stripline 1/8″ × 2″
L14—Glue-down stripline 3/16″ × 2″
Stripline material—.059″ double-sided glass PCB (Meshna PCB 28)
Stripline glue—All purpose adhesive, acetate type (64-2307)
Mounting board—6″ × 11″ double-sided glass, .059″ PCB (Meshna PCB 28)
All fixed capacitors in pF unless otherwise noted. Disc ceramic/50 V
All fixed resistors 1/4 W, 5% unless otherwise noted
Manufacturer catalog numbers in parentheses (Radio Shack and others)

Amplifier/Filter Parts List

Q11, 12—MRF629 (MHZ Electronics)
5-60-pF trimmers (8) (272-1340)
3-10-pF trimmers (4) (272-2338)
C21-C28—5/16″ × 5/16″, 1/16″ minimum air-gap
FT—0.001-μF feedthrough capacitor (Meshna H30)
FB—ferrite bead (2) (Amidon FB-64-101)
Ch6, 9—10 μH (273-101)
Ch4, 7—4T #22 wire, 1/8″ inside dia.
Ch5, 8—15T #22 wire, 1/8″ inside dia.
L20, 21, 26, 27—Stripline 3/8″ × 3″, input/output tap 5/8″ from end, 1/4″ air-gap from mounting board
L22, 28—Interconnect glue-down stripline 1/8″ × 3/4″, groove filed 1/4″ from end to accommodate blocking capacitor
L23, 29—Glue-down stripline 3/8″ × 3/4″, beveled at one end for MRF629 connection
L24, 30—Glue-down stripline 1/8″ × 3/4″
Stripline material—.059″ double-sided glass PCB (Meshna PCB 28)
Stripline glue—All purpose adhesive, acetate type (64-2307)
Filter shields—Inside clearance, 13/16″ × 9/16″, length 2-3/4″
Reynolds perforated aluminum (1/8″ holes spaced 1/4″)
Mounting board—6″ × 11″ double-sided glass PCB (Meshna PCB 28)
Subchassis (2)—2-1/2″ × 3″ × .059″ double-sided glass PCB (Meshna PCB 28)
Subchassis/mtg. board insulation—Sandwich bag plastic
All fixed capacitors disc ceramic/50 V unless otherwise noted
All fixed resistors 1/4 W, 5% unless otherwise noted
Manufacturer catalog numbers in parentheses (Radio Shack and others)

optimum for low noise. The collector current is 10 mA at 7 volts. In the circuit, back-to-back 914 diodes across the input protect the FET gate from input transients. The narrowband T-network at the output discriminates against the 376-MHz image.

In the fabrication, the Q18 X-package gates are mounted on two glue-down pads and the source is mounted on a pad made from #14 wire bent in a U-shaped closed loop. The drain lead is soldered directly to the 10-Ohm resistor, minimizing inductance by carefully bending the lead upward (clamp it with long-nose pliers and bend the remaining portion). I made a noise-source comparison with my old MRF901 preamp. The noise figure is indicated to be improved by a small but measurable amount.

The MC1350 integrated circuit amplifies the 29.6-MHz DBM output up to approximately 40 dB. The high amplification is required to compensate for the interface attenuator. HF transceiver rf feedback is limited by back-to-back 1N914 diodes across the IC output.

Alignment Notes

1. It is required that the MRF tripler operate in a near saturation mode with a collector current of 300 mA or more. A drive of approximately 100 mW is necessary.

2. The transmitter LO and the test-source second harmonic will produce a signal in the 14-MHz band when the receiver antenna is placed near the LO. Adjust C1 for 14.2844 MHz with relay 1 open. Adjust the 5k varactor pot for 14.2855 MHz with relay 1 closed. This results in the 10-kHz offset.

3. TP1 will be over 10 V when the LO is peaked for maximum output. Monitoring the SBM output with the spectrum monitor, null adjustments of C12 and C13 will result in LO rejection of 40 dB while maintaining 10 V at TP1.

4. TP1 will be 13 V or more while in the test mode. Optimize the SBM for maximum 435-MHz output and minimum 405-MHz LO feedthrough. The LO rejection under these conditions will be about 20 dB.

5. Adjust the first filter with a peak voltmeter at C23, optimizing it for the 435-MHz response. Gradually reduce C21 by bending the 5/16″-square plates while continually optimizing the output with C20 and C22. Continue this until there is a slight decrease in response. The second filter is adjusted in a similar manner.

6. With normal amplifier operation, the dummy load will become very hot within a few minutes without forced-air cooling. It can be calibrated for power measurements with a dc voltage, noting the thermistor resistance vs. time. The thermistor in my particular assembly changes from 2 M to 160k in three minutes with 2 Watts input. A similar measurement with 1.5 Watts is 290k, and for 2.5 Watts, 60k. Use a blower to cool off the dummy load between calibration runs. The calibration indicated 2.5 Watts output from the transmitter.

7. In the receiver LO, restrict TP2 to no more than 3 V by increasing the capacitance, C36.

8. The receiver LO and the test source will produce a signal in the 28-MHz band. Set the control-panel pot at the center of rotation and adjust C34 for a signal at 28.8317 MHz. This represents the 58.5017-MHz center frequency. With the proper value of L31, rotation of the potentiometer will result in a frequency variance of ±5 kHz around the 28.8317-MHz center frequency.

9. With all circuits peaked for 29.6-MHz response in the HF transceiver, the DBM will contribute to the noise. This can be checked by disabling the LO (place your fingers on the crystal housing); there will be a small decrease in noise.

10. The rf amp will greatly increase the noise. Optimize the noise figure by tuning C43 and C44 while listening to a noise source or a signal through the antenna (hopefully the OSCAR-10 beacon).

Operation

It is assumed that the transceive converter has been interfaced with the final uplink transmitter.

1. Initiate the test mode and lower the frequency of the HF transceiver 10 kHz as compared to the test-source frequency.

2. Increase the HF transceiver output for optimum uplink power.

3. Tune the control-panel trim potentiometer for satellite response.

4. Switch to normal operation. The system will be in the transceive mode of operation.

5. Check the frequency alignment approximately every hour for Doppler compensation. ■

Receive Converter Parts List

Q13—2N3053 (276-2030)
Q14—2N3819 (276-3035)
Q15, 16, 17—BFX89 (MHZ Electronics)
Q18—MRF966(?) see text (MHZ Electronics)
MC1350 (276-1758)
5082-2835 diodes (4) (276-1124)
1N914 diodes (4) (276-1122)
Y3—58.5117 MHz (ICM 031081)
5-60-pF trimmers (6) (272-1340)
3-10-pF trimmers (5) (272-1338)
Ch10, 11—10 uH (273-101)
L31—22T #26 wire on 1/4″-dia. Plexiglas™ form
L32—10T #22 wire on 1/4″-dia. Plexiglas form
L34, 36—4T #14 wire, 1/4″ inside dia.
L33, 35—2T #22 hookup wire wound around end of L34 and L36
L37—17T #22 wire, 1/8″ inside dia.
L38—20T #26 wire on 1/4″-dia. Plexiglas form
L39—4T #14 wire, 1/4″ inside dia.
L40, 42—6T #14 wire, 1/4″ inside dia.
L41—3T #14 wire, 3/16″ inside dia.
L43—1T #22 hookup wire wound around end of L42
T1, T2—8T #26 wire trifilar wound on FT37-67 toroidal core (Amidon)
T3—10T #26 wire bifilar wound on FT37-67 toroidal core. Secondary 4T #22 hookup wire wound over the bifilar winding (Amidon)
Mounting Board—6″ × 9″ double-sided glass, .059 PCB (Meshna PCB 28)
All fixed capacitors in pF unless otherwise noted; disc ceramic/50 V
All fixed resistors 1/4 W, 5% unless otherwise noted
Manufacturer catalog numbers in parentheses (Radio Shack and others)

Part Suppliers
(Other than Radio Shack)

Amidon Associates, 12033 Otsego St., North Hollywood CA 91607
International Crystal Mfg. Co., Inc., 10 N Lee, PO Box 26330, Oklahoma City OK 73126
John J. Meshna, Jr., Inc., 19 Allerton St., Lynn MA 01904
MHZ Electronics, Inc., 2111 W. Camelback Rd., Phoenix AZ 85015

A Gentleman's Antenna

The solution to an age-old problem: How do you fit a 160m wire onto a 40m lot?

Bill Clarke WA4BLC
Box 2403
Falls Church VA 22042

Only a few years ago, interest in the 160-meter band had lagged to almost nothing. The reason was simple: We as hams had become appliance operators and, until only recently, our appliances did not operate on 160. Well, all that's changed now.

Just browse through this magazine and look at the ads for new all-solid-state HF transceivers. With few exceptions, all operate on the Top Band. Now that the capabilities are there for 160, can most of us operate there? A resounding NO!

The big limiting factor for successful operation on 160 meters is the size of antennas needed. There are two basic antennas that see use on 160: the vertical and the dipole (or its cousin the vee).

Antennas

Verticals are basically low-angle radiators—very good for DX but not so good for local (under 500 miles) contacts. Verticals also require extensive ground work. This means much digging and laying of radials, with the end result supposedly a "perfect rf ground." It is a lot of work that can involve thousands of feet of wire for the radials and an equal amount of digging. Then there is the reseeding of the damaged lawn, to say nothing of what the XYL has been saying about your efforts. I won't even mention those quiet whispers among the neighbors.

There is an easier way: a dipole antenna. It is a wire antenna, as I am sure you all know, requiring only a feedline and a place between supports to hold it up in the air. No ground radials! Of course you do need 246 feet between the supports. That 246 feet is a long way—in fact, so long that most suburban antenna farms (house lots) cannot hold it. You could ask your neighbor if he would mind if you hooked part of your antenna into one of his trees. You know your neighbor... the one that owns the new TV you tear up on 20 meters during "Monday Night Football."

If you're like me, you don't want to owe your neighbor anything. I'll do it myself, thank you. So now what do you do? Build a reduced-size dipole. It's a good idea, you say, but you don't want to do all the math, right? OK, read on—I've done it for you.

The Short Answer

A shortened dipole is inductance loaded. This inductance must be placed between parts A and B of each dipole element (see Fig. 1). The inductance and element lengths vary depending upon the total length of the antenna used.

Measure between the two supports you plan to use (or measure the height of the single support you plan to use in the case of an inverted vee). Remember that the larger (closer to full size) the antenna is, the more efficient it will be (see Table 1). Table 1 is based upon computer design information for 1.9 MHz.

Coil Construction

In Table 1 the number of

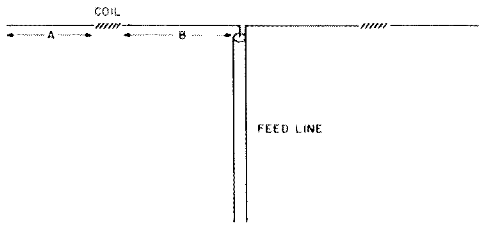


Fig. 1. An inductance-loaded shortened dipole.

Overall Length (ft.)	Element A Length	Number Of Coil Turns	Element B Length
246.3	full-size antenna		
221.3	66.5	10	44.3
197.1	59.1	20	39.4
172.4	51.7	33	34.5
147.8	44.3	48	29.6
123.2	36.9	65	24.6
98.5	29.6	86	19.7

Table 1.

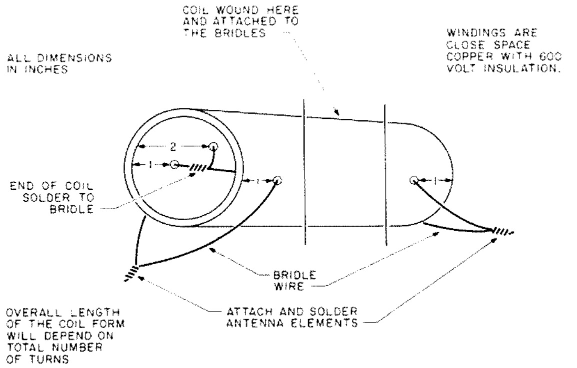


Fig. 2. Loading-coil detail.

turns for the coil is given. The coil is made by winding #12 insulated house wire on a form made of 2½″-outside-diameter plastic pipe. I use 2″-inside-diameter Amoco rigid PVC conduit. The wire is close wound, with the plastic insulation acting as the spacer. The result is a coil with a pitch of 8 TPI (see Fig. 2).

Installation

The antenna is installed exactly as any other dipole or inverted vee. I do not recommend the use of a balun but suggest the use of a good center insulator and RG-8 coax (you will probably be running an amplifier someday). The antenna is tuned by the usual method of an swr bridge and trimming or adding to the ends of the elements. To raise the resonant frequency, shorten the antenna. To lower it, lengthen the antenna. ■

Richard J. Bailey
68A Church Street
Conic NH 03867

Probe the Unknown

Looking for an easy way to measure rf? Use the "electric pen," a no-load active probe with real flair!

While trying to align a surplus receiver, I found I needed an rf probe. I threw together the typical rf probe found in all the handbooks. This probe, shown in Fig. 1, consists of a .01-uF capacitor to block the dc component of the signal, a shunt germanium diode which develops the voltage across it, and a simple RC filter to smooth the output waveform. I twisted the component leads together, connected the makeshift probe to the circuit, and tweaked the adjustment of the LC circuit I was trying to align from one end to the other without finding a peak. After the usual amount of cursing and contemplation of the ramification of Murphy's Law (with its usual corollaries), some semblance of reason prevailed and a more scientific approach was decided upon to try to find the solution to the problem.

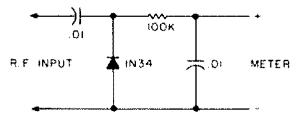


Fig. 1. Simple rf probe.

The LC circuit I was trying to align was in the synthesizer section of the receiver with a crystal-derived known frequency across it and within the range of one of my other receivers. I loosely coupled the antenna lead of the receiver to the high side of the LC circuit, tuned the receiver to the correct frequency, and found I could easily peak the circuit using the S-meter on the second receiver. I realized that the problem was that the probe had far too much loading for the circuit and had detuned the circuit so much that the adjustment didn't have enough range to bring it back in.

After congratulating myself on the speed with which I had found the solution (two hours including cursing), I decided what I obviously needed was an rf probe that would operate over the range of frequencies that I normally use, have good sensitivity, and not load the circuit. It seemed that some form of impedance transformation was required. An emitter follower wouldn't fill the bill because the input impedance is relatively low. Junction field-effect transistors (FETs) have a high input impedance and aren't too likely to be zapped. However, when used as a source-follower, the output impedance must be kept quite high in order to get reasonable gain. The solution was to couple a source-follower input stage to an emitter-follower output stage and end up with a circuit that has a high-impedance input and a low-impedance output.

If you've read this far, you realize that I've reinvented the input circuit that is used in many frequency counters, both commercial and homebrew. Well, great minds run in the same channel, right? I found I could get −5 V from my analog meter, so the final circuit uses a P-channel FET and a PNP transistor; it is shown in Fig. 2. If you have +5 V available, you could try substituting a 2N5457 and a 2N3904 for the transistors I used. It might be wise to breadboard the probe if you plan to make substitutions, just to make sure everything works.

Next comes the problem of packaging. If you can find some of the subminiature .01-uF capacitors that are about the size of a 1/4-Watt resistor, the unit can be built inside a ball-point pen (actually it's like building a ship in a bottle—you build the circuit outside, *then* slide it inside the pen). A pictorial diagram of the probe is shown in Fig. 3 for those of you who want to try this method. It is important to use plastic transistors with one flat side (TO-92) to allow room for the component leads to pass by the transistors if you build the pen version—otherwise nothing is critical. Component leads for the pen version are just laid side by side and soldered with a minimum of

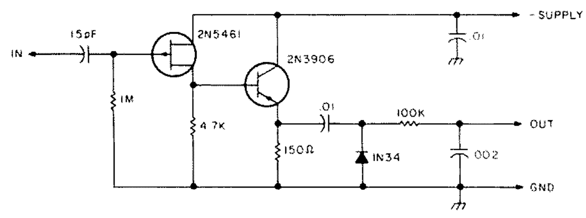


Fig. 2. Rf probe schematic.

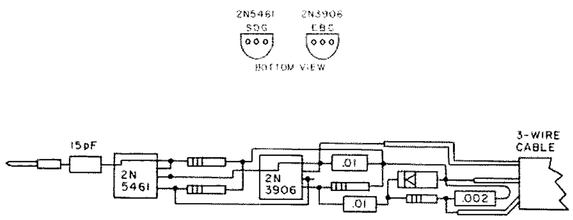


Fig. 3. Pictorial diagram.

solder. Sleeving may be used where it's deemed necessary, but after the guts of the probe are assembled, the leads may be bent so there is no danger of them touching.

Test the probe by applying a signal to the probe tip and reading the output on your meter. If the probe checks out OK, you can glob epoxy on the probe tip, transistors, and cable and slide it into the pen body. I used a pin with a shoulder from a surplus connector for the probe tip. Pull the tip with a pair of pliers until the shoulder hits the end of the pen. Screw the two halves of the pen together and quickly retest the probe to make sure you didn't short anything out assembling the probe. Let the epoxy harden.

The probe will work from 15 kHz to beyond 30 MHz at levels of up to 2-1/2 V without clipping, from a −5-V supply, and supplies up to −15 V can be used for the supply. The input is sensitive enough to pick up an rf signal of about 1 V if the probe tip is just placed near the insulation of an unshielded wire or near a tuned circuit carrying the signal. In most cases the stray capacitance of the probe cable is great enough compared to the input capacitance so that no ground return is necessary. The dc output voltage of the probe is about 20% lower than the rms input, but this is generally no problem if you are only interested in the relative value of the signal, i.e., peaking a tuned circuit. Diode type probes, whether they are active like this one or passive like the handbook version, are quite nonlinear on low-level signals, so calibration was considered a waste of time.

Two notes of caution: When using the probe, remember not to stick it in your pocket and walk off with it. Also be prepared for comments like, "Wot ya gut there, an electric pen?" ■

Mike Starcher KB4YJ
2707 Gleeson Lane
Jeffersontown KY 40299

It's a Dangerous Obsession

Growing up and learning about electronics is like driving a car before you can reach the brake pedal. KB4YJ tells how he lived through it.

Growing up in a small town in West Virginia was hard, especially for a kid like me who was always trying to find out what made things work. I wasn't satisfied with just reading or hearing about something; I had to see for myself. This meant tearing apart everything I could latch onto and drag home.

The kids my age thought I was weird. They were content with bouncing a basketball or tossing a baseball around all day. As for me, I preferred to spend a nice afternoon dissecting an old five-tuber on the kitchen table.

Most of the adults around me frowned on this unusual behavior, too. They would say things like, "That boy's gonna get shocked to death some day if he keeps on."

My mom was always warning me about the dangers, too. She was always telling me to stay away from things like golf balls or flashlight cells which were full of acid, or vacuum tubes which contained deadly poison. It seemed like all the neat things were booby-trapped in one way or another to take care of any knucklehead who tried to pry them open.

My dad encouraged me, though. He would say, "You keep on tearing up things, boy, and someday you'll make good."

My uncle Howard was understanding, too. He was the town's "trash man." Once a week he would bring his big truck around to collect the garbage. He saved anything he thought I would like and placed it in a special pile in the front of the truck. That pile was a gold mine to me. Clocks, fans, motors, old radios, and many other goodies were there to greet me when he came. I would pack it in, tear it apart, and he would get most of it back the following week.

I saved a lot of parts back then, even though I didn't know what they were. Every now and then I would get some of them out and say, "Gee, aren't those neat," even though I didn't know what I was going to do with them. (I still do that today, especially when I've just returned from Dayton.)

I was kind of short in the way of tools, having only a screwdriver, bicycle pliers, a pocketknife, and a big nail that I heated on the gas stove for soldering. This made it rough getting some things apart. A lot of the stuff was held together with ¼-inch hex-head screws. The people who made these must have known there would be someone like me gnawing them out with pliers someday.

My tool arsenal expanded greatly when my older brother brought me a soldering gun one Christmas. I was still pretty young at the time, so Mom envisioned the house burning down. She let me keep it, though, after a little nudge from Dad. Well, I didn't burn the house down, but I did lose a few shirts, a pair of pants, and a bedspread due to burn holes.

By the time I was nine, I had learned enough to think I could start fixing things. As I soon found out, folks were not exactly anxious to let a nine-year-old work on their radio or television. So, my first clients were some friends at school. They would bring their watches to me and I would take out a few parts which made the hands run around the dial real fast. Sometimes their parents made them return the watch for me to undo. Did you ever try to get all those gears to go in their holes while you put the two halves back together?

Later on in my youth I did acquire some friends who enjoyed the things I did. One such friend and I decided to build a telegraph system from my house to his about four blocks away. We started by building the sending and receiving apparatus. The sending key was easy, made from one of the "I's" out of a transformer core nailed to a block of wood. The receiver was another story. The only power source we had was the wall outlet, so we would wind a nail with a mile of wire out of an old television focus coil, plug it in, and when the smoke cleared, wind two

miles, and so on. We finally settled on a wad of wire which lasted about 15 seconds before incinerating. We agreed that this would work if we learned to send code fast enough.

Next came the running of the telegraph line, which was the rest of the focus coil. We didn't have a tall ladder, nor did our homemade pole-climbing shoes help us when we tried to string the wire over the existing telephone poles. So we just threw the roll over one pole and then the next. This method didn't work, to say the least. First the roll didn't fare too well because we didn't always catch it on the other side. Then we ran out of wire about a block short and gave up. For the next few days the neighbors complained about the "hair" wire someone left hanging about neck level around there.

A few months later we had perfected the telegraph sets. By using lantern batteries the coil didn't burn up anymore, and we had found something to use for the lines. This something was the gas and water lines which were right under our noses all along. It stood to reason that the two were metal and they both were connected between our houses, so the test came one night. I had the sending end armed with two almost fresh 6-volt lantern batteries and the key connected to the gas and water lines, respectively. I got on the phone.

"Are you ready on your end?"

"All set here."

"OK, key is down; did you get it?"

"Nothing here."

I checked connections and tried again; still nothing. The only thing I could think of was that the batteries were too weak to go all that way. So I went to the next most powerful source, the good old wall outlet. After installing a line cord, I was ready for another test.

"OK, you should get it this time."

I closed the key . . . wham! I was sitting in the dark. There were only two fuses in the whole house. Back to the phone.

"Gee, it acts like a dead short!"

We gave up for lack of more fuses and the fact that Dad was home at the time. Being as smart as I was, it didn't take long to figure out what went wrong. I surmised that somewhere between my house and his the gas and water lines crossed each other and there was the short!

As I became older, I soon discovered there really were hidden dangers in the things I worked on. Like when I grabbed hold of my first 5U4G to unplug it and learned about second-degree burns first-hand! A lesson was provided when I pulled the high-voltage anode lead out of a picture tube without first discharging it. The sharp high-voltage cage on which I left curly-cues of skin as I got away from the picture tube was equally terrifying.

Some of the things I did left lasting impressions, such as the time I built my first power supply, 350 volts at 200 mA, and laid my hand on the power transformer to see how hot it was while holding the B+ lead in the other hand! For awhile, I thought the folks were right about getting shocked to death!

Somehow I survived being a kid. I did a lot of unusual things and had a lot of fun back then. Now I'm all grown up and have two boys of my own. And Dad, I haven't exactly made good yet, but I'll pass the good advice along to my sons and maybe someday when I'm left sitting in the dark, I'll remember you and the time when I was a kid.■

David J. Nicolaus WB9AOU
956 N. 200 W.
Valparaiso IN 46383

John Van Willigan WD9ADZ
831 Opal Drive
Valparaiso IN 46383

Convert and Converse

Transform your C-64 Basic programs into Hamtext-readable sequential files.

A great many amateurs are now finding room in their ham shacks for home computers. The use of RTTY on the ham bands is growing by leaps and bounds thanks to the many new programs now available for these computers. One of the most popular combinations in this area seems to be the Commodore 64 and Hamtext™ by Kantronics. Which brings us to the subject of this article.

Did you know that you can use Hamtext to transmit programs over the air in ASCII? In the ensuing paragraphs, we will attempt to instruct you in our method of sending and receiving a usable program over the air and how to convert the resultant sequential file back into that program again.

"Convert" was designed to be used with Hamtext, a Commodore 64, and the 1541 disk drive. Hamtext stores the received program in a buffer, which, when saved to disk, becomes a sequential file. This file, as you know, is useless until converted back into a program. Convert will take this sequential file from disk and convert it to a usable program. For those of you who want to get into the meat of this program and could care less how it works, we will get right into the basic instructions. For those who care, we will explain the whys and wherefores of the program after the instructions.

```
63770 GOTO 63950
63780 PRINT"IF YOU WISH TO DESTROY THE CONVERT PROG, ENTER GOTO 63790":END
63790 PRINT" CLR ":FOR A=[illegible] TO [illegible]:PRINT [illegible]:NEXT:PRINT [illegible]:END
63800 D$=STR$([illegible]):F(1)=VAL(MID$(D$,[illegible])):F(2)=VAL(MID$(D$,[illegible]))
63810 F(3)=VAL(MID$(D$,[illegible])):F(4)=VAL(MID$(D$,[illegible])):Y=1
63820 FOR Z=[illegible] TO [illegible]:POKE Z,F(Y):Y=Y+1:NEXT
63830 RETURN
63840 Z=[illegible]=PEEK(Z)*1000+PEEK(Z+1)*100+PEEK(Z+2)*10+PEEK(Z+3)):RETURN
63850 INPUT" CLR  DWN  DWN FILE NAME";F$:PRINT"OK, NOW LOADING BUFFER.
      PLEASE WAIT."
63860 OPEN [illegible]
63870 GET #1,A$
63880 A=ASC(A$):POKE [illegible]
63890 IF ST=0 GOTO 63870
63900 CLOSE 1:PRINT"DISK ERROR";:OPEN 15,8,15:INPUT #15,E$,D$:PRINT
      E$,D$:CLOSE 1:CLOSE 15
63910 CLOSE 1
63920 PRINT" CLR ":[illegible]
63930 PRINT" CLR ":PRINT""
63940 GOSUB 63840
63950 [illegible]=PEEK([illegible])
63960 PRINT CHR$([illegible]):IF [illegible] THEN PRINT" [illegible] OK.":GOTO 63780
63970 IF A[illegible] THEN GOSUB [illegible]:GOTO [illegible]
63980 GOTO 63950
63990 FOR [illegible] TO [illegible]:POKE [illegible]:PRINT"[illegible] 63930 HOM ";
```

The Convert program.

Instructions

Before getting on the air, a few preliminaries are in order. You must convert the program that you are going to send into a sequential file and save it to disk. This must be done before loading Hamtext. While still in Basic, load the program to be sent into memory as you normally would do. Then type in the following commands in the direct mode:

OPEN 8,8,8,"name,S,W":CMD8:LIST

then press Return. A sequential file will now be written to disk with whatever name you have chosen. When the computer is done writing, type CLOSE8 in the direct mode and press Return. This will close the file and stop the disk drive. Now you are ready to load and run Hamtext. From the menu select the T/R options and set them as follows:

A.	USOS	Off
B.	Diddle	Off
C.	Audio Feedback	Choice
D.	Auto ID	Off
E.	Wraparound	Off
F.	Auto CR	Off
G.	Auto LF	Off
H.	TU	Whatever

This setup is very important. Do not forget to set your options in this manner before you start or you will find your program full of carriage returns and other strange things that do not belong there. When the time comes to transmit your program, have the receiving station stand by and return to receive mode.

Type the following in the transmit buffer (with no spaces):

Control-FD:nameControl-F

and then press F2 to begin your transmission. (The name is, of course, the name you gave the file when you saved it to disk.) After pressing F1, your part of the operation is now over.

If you are the receiving station in this operation, you should also be sure that your T/R options have been set as instructed. When the sending station informs you that it is ready to send the program and stands by for a moment, you should now press F8 and clear your buffer. This simple task will save you a lot of work later on.

After receiving the program, go to the edit buffer mode and delete anything not relevant to the program. The buffer should start with the number of the first line of the program and continue to the end. At the end of the last line in the program, you should see a reverse M. You must add a Control-C after the reverse M. This should appear on the screen as a reverse C. If you didn't clear your buffer before you started, you know by now why you should have! You probably have worn out your delete key getting rid of all the garbage. At this point, make sure that no line number in the object program is above 63769 or you will cause the Convert program to crash. It starts at line num-

ber 63770 and will be overwritten by the object program. If this problem should occur, you will have to delete the offending lines and add them later when in Basic. This should not be too big a problem since line numbers seldom run this high in a program. If you are the transmitting station and your program does have these high line numbers in it, change them now and save the other fellow a lot of time.

After editing your buffer, save it to disk. Later, when you go off the air and return to Basic, load and run Convert. You will be prompted to enter the name of the file. Convert will then go to the disk, get the file, and begin to create a program from it. You will now see each line appear on the screen as it is entered. This is quite fast, so look quick.

If all goes according to plan, you will see a prompt informing you that the program is now complete. You will also be given a line number to GOTO that will list all the line numbers of the Convert program on the screen. With the aid of the cursor keys, move the cursor to the top of the screen and press Return on each of these numbers. When you reach the bottom, you will have deleted the Convert program from memory. If you now run a LIST, you should see your new program ready to save to disk. As with all programs, you should save it first before debugging it. After all this, who wants to lose it now!

There is a remote chance, even after following the instructions carefully, that you could encounter a few minor problems. They could be caused by the fact that we are not very good at giving instructions. (Come to think of it, we are not very good at taking instructions, either!) Or they could be caused by the old line-too-long problem. Sometimes a program line can have more than 80 characters. Any line that is over two screens long will mess things up.

How can this happen? When originally entered, the writer used the Commodore shorthand and thus kept within the two-line limit. Later, when the listing was converted to a sequential file for transmission, the words were extended out and over the limit. This might be something for the transmitting station to look for back in step one. Or you, as the receiver, while still in Hamtext, could look for this when editing the buffer before saving it. If you look for it there, you can break the line up into two lines.

If still in Hamtext, you won't be able to use the shorthand symbols except for PRINT. Very often you will be able to delete the PRINT command and use Commodore's shorthand, the question mark. This will save you four spaces, and sometimes that's enough.

Sometimes you will miss these lines and when running Convert, the program runs into them and stops. Now what? If line GOTO 63930 is still on the screen, run your cursor up to it and press Return. If not, just enter GOTO63930 in the direct mode and press Return. Things should pick up right where they left off.

Pay particular attention and note the next line number to be entered. When done, check the line before it. A small part of this line will be missing and you will have to find out what it is and replace it. The only way to find out, if you don't know, is to load up Hamtext and load the file back into the buffer. When you find the line in question, write down the missing information and enter it later when you return to Basic.

Whys and Why Nots

After studying a routine for changing sequential files to programs using a dataset, we determine that this procedure would not work with a disk drive. The dataset routine simply reads one line of the program from the sequential file off the tape, stops the tape, and then prints that line to the screen and enters it into the program. It then restarts the tape, which is in position to read the next line, and executes the same thing over and over until the end of the file.

The problem with a disk drive is that when you break the program to enter a line, the act of entering a line resets all variables and the disk returns to the start of the file. Thus we would just enter the first line of the program over and over.

We can't count the number of lines into the program because of the variable reset. Also, reading the program from the beginning after each line would be very time consuming. Convert starts by opening the file on the disk, reading it one bit at a time, and POKEing its ASCII value into high memory (49152) where it is a little more accessible and workable than on the disk. Each ASCII value is tested for a three, which is the Control-C (indicating the end of the file), that we entered back in Hamtext.

It should be mentioned at this point that POKEing the file into high memory, starting at 49152, limits you to programs of 4K or less. This equates to 16 blocks on a 1541 disk drive. Longer programs can be entered by breaking them into two or more parts and saving them to disk under different names. Then, using the combine feature of the COPY command found in your 1541 user's manual, you can combine them into one program.

After POKEing the sequential file into high memory, it is read and printed back to the screen one character at a time. While doing this, Convert is testing each character, looking for flags. The first is a 13, the Return command, indicating the end of a program line. The second is a three, the Control-C we affixed at the end of the file to signal the end of the program.

When a Return is encountered, we GOTO line 63800. This starts a subroutine that disassembles the variable C and stores it in low memory. C is the address of where we are in the sequential file that is stored in high memory. Moving right along to line 63990, we POKE four Return commands into the keyboard buffer (memory locations 631 to 634) and POKE a four into memory address 198 to tell the computer they are there. Then, before ending the program, we print a GOTO 63930 command below the program line we have just printed on the screen. We then end the program with a cursor HOME command.

Now the program has supposedly ended and the cursor is positioned at the top left of the screen just above the program line that is to be entered. But wait, what's this? The keyboard buffer still has four commands waiting to be executed!

The first Return places the cursor on the program line and the next causes that line to be entered into memory. The third Return executes the direct GOTO command which was left on the screen by the print portion of line 63990. This then puts us back into the program in line 63930, clears the screen, and we are off and running again.

In line 63940 we go to subroutine 63840. This routine PEEKs the low memory where we stored the value of C and reestablishes the address of where we are in the sequential file. This loop will continue in this manner until an ASCII 3 is encountered. The Control-C or ASCII 3 flags the end of the program. But wait! What happened to the fourth Return that was POKEd into

the keyboard buffer? Nothing. It was only put in as an extra to ensure that the cursor reached the direct GOTO command.

A prompt on the screen now tells you to GOTO 63790 if you wish to destroy the Convert part of the program. Going to 63790 causes the program to list all the line numbers on the screen. It is now a simple matter to press the Return key on each of the numbers and remove the lines from memory.

The Fine Print

Some of the commands in Commodore's Basic are not retransmitted by Hamtext. This includes most of the graphics and the CLR command. These inconveniences will have to be dealt with individually. The CLR command will come through as a HOME command. Usually, with a little scrutinizing of the program, you can decide which it should be.

Other commands to watch for are cursor up, down, left, and right. Hamtext will ignore these and leave them out of the transmission. The best way we have found to get around this problem is to replace all the symbols in the program with bracketed commands such as <CLR> for clear screen or <CUR/UP> for the cursor up token. Then save the program to disk as a sequential file to be transmitted later. If you take a little time to prepare your files in this manner, the person receiving it on the other end will then be aware of what the command should be and can correct it in his final program.

This system has been working well for us. It does require a little setup time on your end, but we think you will be pleased with the results. it won't be long before you have several disks full of sequential file programs ready to transmit to other hams.■

BARTER 'N' BUY

Individual (noncommercial) .... 25¢ per word
Commercial .... 60¢ per word

Prepayment by check or money order is required with your ad. No discounts or commissions are available. Please make your payment to *73*. Rates for multiple insertions are available on request.

Advertising must pertain to amateur radio products or services. No special layouts or positions are possible. All advertising copy must be submitted typewritten (double-spaced) and must include full name and address. Copy limited to 100 words, maximum. Count only words in text. Address, free.

73 cannot verify advertising claims and cannot be held responsible for claims made by the advertiser. Liability will be limited to making any necessary corrections in the next available issue.

Copy must be received in Peterborough by the 5th of the second month preceding the cover date.

Make checks payable to *73* Magazine and send to: Jim Gray, Advertising Department, *73* Magazine, 80 Pine St., Peterborough NH 03458.

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

ARRL SWEEPSTAKES
CW
Starts: 2100 UTC November 2
Ends: 0300 UTC November 3
PHONE
Starts: 2100 UTC November 16
Ends: 0300 UTC November 17

US and Canadian stations work other US and Canadian stations using 1.8- through 28-MHz bands. Operate no more than 24 of the 30 hours with on/off times noted clearly in your log. Listening time counts as operating time. Operating categories include single operator and multi-operator with a single transmitter.

No crossmode contacts, and each station can be worked only once regardless of frequency band. A transmitter used to contact one or more stations may not subsequently be used under any other call during the contest period (with the exception of family stations where more than one callsign is assigned by FCC/DOC). One operator may not use more than one callsign from any given location during the contest period. The use of two or more transmitters simultaneously is not allowed.

EXCHANGE:

Consecutive serial number, precedence (A if you run 150-Watt output or less, B if more than 150 Watts), your callsign, check (last two digits of the year you were first licensed), and your ARRL section.

SCORING:

Count 2 points for each completed 2-way QSO. Multipliers are each ARRL section plus VE8/VY1 (74 maximum). KP4, KV4/KP2, and KG4 stations are in the West Indies section, while KH6 and other US possessions in the Pacific count as the Pacific section. Final score is QSO points

CALENDAR

Nov 2-3	ARRL Sweepstakes—CW
Nov 2-3	ARRL EME Competition—Part 1
Nov 2-3	IPA Contest
Nov 9-10	Delaware QSO Party
Nov 9-11	CO WE Contest
Nov 10	International OK DX Contest
Nov 16-17	VK Versus The World CW QRP Contest
Nov 16-17	ARRL Sweepstakes—Phone
Nov 23-24	ARRL EME Competition—Part 2
Dec 7-8	ARRL 160-Meter Contest
Dec 14-15	ARRL 10-Meter Contest
Dec 28–Jan 1	QRP Winter Sports—CW
Jan 11	73 40-Meter World SSB Championship
Jan 11-12	Hunting Lions In The Air Contest
Jan 12	73 75-Meter World SSB Championship
Jan 18-19	73 160-Meter World SSB Championship
Jan 25	73 15-Meter World SSB Championship
Jan 26	73 20-Meter World SSB Championship

RESULTS

K3TUP, 40-meter multi-op champion for the third consecutive year.

40-meter DX single-op champion DJ3HJ.

KE5CV, K3TUP, I4KDJ, AND DJ3HJ: 1985 WORLD 40-METER SSB CHAMPS

This has been an unbelievable year on 40 meters. The defending multi-op World Champions, K3TUP and crew, captured their third consecutive title. Returning World Champion KE5CV scored a decisive victory in the single-operator class.

DX station I4KDJ, vying for its second world title in the multi-op category, managed to outscore its nearest competitor by nearly three to one. Earning his first World Championship for the single-operator class was DJ3HJ from West Germany.

Whew, what talent. These stations are not to be denied their place on the 40-meter Honor Roll.

40-Meter World Champions

	1982	1983	1984	1985
W/VE Single Op	VE5DX	KC5NQ	KE5CV	KE5CV
W/VE Multi-Op	N9NB	K3TUP	K3TUP	K3TUP
DX Single Op	YV5ANE	4M3AZC	KD7P/KH2	DJ3HJ
DX Multi-Op	I4YNO	I5NPH	I4KDJ	I4KDJ

Multi-band contests are won or lost on 40 meters. Top contesters openly admit that a respectable 40-meter operation will spell the difference between first, second, and third place. Is it any wonder that the 40-meter single-band event has become one of the most popular?

In the single-operator class, only 4 contacts separated KE5CV and K4XS at the finish. Multipliers decided the overall winner. KE5CV had 56 states/provinces and 47 DX countries to acquire a total of 103 multipliers. Totaling 91 multipliers, second-place station K4XS worked 53 states/provinces and 38 DX countries.

DJ3HJ won DX single-op honors by working 316 Qs, only 7 W/VE multipliers, and a whopping 84 DX countries. This multiplier total was more than his nearest competitor, Alaskan station KL7U, could muster. While KL7U worked 20% more stations than the champion, propagation just did not provide the overwhelming DX total yielded by the West German station.

Multi-op competition has never been greater. The crew at K3TUP set a new World QSO Record with 1381 QSOs in the 24-hour contest, surpassing last year's record of 1214. K3TUP literally walked away with their third World Championship. Second-place finisher KYØS was one short of matching K3TUP's multiplier total of 84. They could not, however, make up the difference of 242 Qs.

World Championship recognition seems to be due our friends in Italy. As the preceding chart illustrates, the DX multi-op title has gone to an Italian station since the beginning of this event. 1985 World Champion I4KDJ is an example. This is the second time this station has been awarded top honors for this contest category!

Championship competition breeds new world records. Let's take a look at QSO records for each operator class:

World 40-Meter QSO Records

Single Operator			Multi-Operator		
KE5CV	1985	1,200	K3TUP	1985	1,381
K4XS	1985	1,196	K3TUP	1983	1,214
W1WEF	1984	1,042	K3TUP	1984	1,196
KE5CV	1984	1,020	N4DDS	1985	1,151
N6YK	1985	1,012	KYØS	1985	1,139
KE5IV	1985	1,009	K8ND	1983	1,129
VE5DX	1982	972	N9NB	1982	1,098
KE5IV	1984	953	W2ZQ	1985	1,064
NC2V	1985	931	K9EC	1984	1,008
K9EC	1985	915	WA4JXI	1985	990

As usual, Canadian multipliers were at a premium. Too bad the VEs don't support this championship event more than they do. Stations with 50 or more states and provinces to their multiplier credit include: WA4JXI (57), K5LZO (56), KE5CV (56), KØHA (56), N6YK (55), K3TUP (55), KYØS (55), KS9O (55), N4DDS (54), NC9F (53), WA6PVA (53), K4XS (53), KE5IV (53), K9EC (53), N9GT (53), N8CXX (53), NC2V (52), KA1GG (52), VE3MFP (52), WB7APW (52), WD5GSL (52), KBØC/9 (51), AE5H (51), W4TMR (51), W2ZQ (51), W9UCW (50), K1KJT (50), and KQ1F (50).

Stations with 30 or more DX countries include: DJ3HJ (84), I4KDJ (65), I4AVG (48), KE5CV (47), K4XS (38), N6YK (38), WA4JXI (32), KE5IV (30), and K3WGR/VP2 (30).

As we looked over the contest entries, we thought it would be interesting to note the various antenna combinations being used in this event:

ANTENNAS USED (%) IN THE 40-METER CONTEST

33	Inverted vee/dipole
15	Vertical
12	2-element yagi
9	3-element yagi
8	4-element yagi
5	Delta loop
4	Longwire
3	¼-wave sloper
3	½-wave sloper
3	Wire beam
2	2-element quad
2	Phased vertical
1	Log periodic

Reviewing the antenna survey, we can see a definite trend toward more sophisticated arrays. While inverted vees and dipoles remain the overall mainstays, the monobander appears to be a must if you want to be in the top five! *(KE5CV called me the other evening and convinced me to replace the 2 element with a third rod! Guess what? He and NE6I were right; it's worth it!—KE7C).*

Have you ever asked yourself what makes a championship station? We thought we'd share the descriptions of this year's top five stations in each operator class. Of course, it doesn't hurt to have a seasoned operator at the helm either:

Single Op:				
KE5CV	TX	TS-930	Alpha 76PA	4-el KLM, wires
K4XS	FL	TS-930	Alpha 78	4-el KLM, inverted vee
N6YK	CA	TS-930	Alpha 77D	4-el KLM
KE5IV	TX	TS-930	Alpha 77D	4-el KLMs stacked
NC2V	NJ	TS-930	TL-922	4-el KLM
Multi-Op:				
K3TUP	PA	TS-930	Alpha 77D	4-el KLM, dipole
WA4JXI	FL	TS-830	TL-922	2-el yagi, sloper
N4DDS	TN	FT-902DM	Drake L-7	Longwire
KS9O	IL	IC-751	IC-2KL	3-el KLM
I4KDJ	Italy	TS-930/FT-901		Phased verticals

Note: KYØS was second-place multi-op but we do not have his station description.

On behalf of our 40-Meter Contest chairman, Dennis Younker NE6I, I want to thank all those who participated in this year's event. Many of you didn't turn in an entry and that's unfortunate. If you had, perhaps you could have earned a contest award. Please, next year, just take a few moments, put together your entry, and send it in. You'll be glad you did.

Speaking of next year, the 1986 40-Meter World Championship Contest is scheduled for 0000-2400 UTC, January 11, 1986. The rules are already printed and available right now! This year we have a special address for ALL CONTEST RULES AND FORMS. If you inquire about one contest, you'll receive rules and forms for all our single-band events. Send an SASE to: *1986 Contest Rules and Forms, Billy Maddox KA3JJK/3, 1162 Bayview Vista Drive, Annapolis MD 21401.*

Though many of you were not able to earn an award, you made achievements in other ways I hope. Perhaps you contacted that 50th state or added another DX country to your totals. You're all worthy of honorable mention and we appreciate your dedication to this annual contest. Please ask your friends to join us in the 1986 contest. Thank you for your support and see you on 40!—*Bill Gosney KE7C.*

40-Meter Soapbox

KA2IEU (W2ZQ op)	Learned every dirty trick we know from W3BGN! Hi, Hi.
N3BJ (K3TUP op)	Excellent way to get away from XYL after a New Year's hangover.
N4DDS	Lost 30 minutes of operating time handling emergency traffic for WA3TAI and the NTS.
N4GTU	Great contest with excellent propagation here on the East Coast.
W4TMR	Always a great contest. I'm looking forward to next year.
K4VKZ	Amp burned up. Blew flames out and continued running barefoot. *(Ed. note: Talk about dedication!)*
WD5GSL	Why would two otherwise normal guys spend ten hours in an uninsulated trailer (ham shack) in the middle of a cow pasture just to freeze their buns off? To operate the 40-Meter World Championship, that's why!
WA5IYX	Record snowstorm here began about 0600Z and provided considerable distraction for the remainder of the contest.
KC7PA	Doubled last year's score. Daytime activity was way up this year.
N8CEO	Had lots of fun. No bowling next year so I can devote all my time to the event.
N9DHX	Enjoyed working Oregon and Arizona for the first time operating QRP.
NC9F	24-hour format is great. You can operate a contest and still have a weekend.
NØCLV	First time in the contest. Had a great time. See everyone again next year.
VE3MFP	High-tension wires (300 kV) 400 feet away started to arc. What a noise level!

times the number of ARRL sections (plus VE8/VY1).

FREQUENCIES:

CW	Novice	Phone
1800-1810		1855-1865
3550-3650	3710	3850-3950
7050-7100	7110	7200-7250
14050-14100		14250-14300
21050-21100	21110	21300-21400
28050-28100	28110	28550-28650

AWARDS:

Certificates to the top single-operator CW and phone scorers in both the A and B categories in each ARRL section, and the top multi-operator entry in each ARRL division.

ENTRIES:

Contest forms (log sheets, summary sheet, dupe sheet) are available from ARRL headquarters for an SASE. Official forms are recommended. Any entry claiming more than 200 QSOs must submit duplicate checking sheets. Incomplete or late entries will be classified as check logs. Logs should include dates, QSO times, exchange sent/received, band, and mode. Postmark your entry for either mode by December 21st. Send to ARRL, 225 Main Street, Newington CT 06111.

Each entrant agrees to be bound by the provisions as well as the intent of the official ARRL rules, the regulations of his licensing authority, and the decisions of the ARRL Awards Committee. Usual disqualification rules apply.

1985 RESULTS

40-Meter World SSB Championship Contest

Indicated are callsign, QTH, QSOs, states/provinces worked, DX worked, and total score.

** World Champion * State, Provincial, or Country Champion

Two-time 40-meter single-op champion KE5CV.

W/VE Single Operator

**KE5CV	TX	1,200	56	47	704,520
* K4XS	FL	1,196	53	38	567,840
* N6YK	CA	1,012	55	38	539,400
* KE5IV	TX	1,009	53	30	443,635
* NC2V	NJ	931	52	20	344,520
* KØHA	NE	813	56	24	338,000
* K9EC	WI	915	53	15	317,560
* KA1GG	MA	804	52	21	303,680
K1KJT	MA	778	50	15	257,725
KQ1F	MA	739	50	13	236,565
* N9GT	IN	767	53	8	236,375
* VE3MFP	ONT	479	52	31	227,420
* N8CXX	MI	600	53	13	202,620
KBØC/9	IN	612	51	13	200,960
* AE5H	MS	480	51	7	142,680
K4VSK	FL	454	49	11	139,800
* N4JII	TN	552	47	2	137,200
* WB7APW	AZ	403	52	9	132,370
* W4TMR	NC	387	51	11	124,000
* N3DED	PA	477	44	2	110,400
* WA1BBB	NY	470	44	2	108,330
K8JM	MI	424	46	4	107,000
* W1WEF	CT	420	49	1	105,250
* AK1A	NH	388	41	11	103,740
KVØI	NE	391	49	2	100,215
* KDØHY	IA	349	49	7	99,680
* KA1SR	RI	354	44	10	98,820
* N4KWX	VA	387	45	4	96,040
* KB8AC	IL	316	48	10	95,410
* KI4XB	GA	341	46	5	88,230
NF4F	TN	361	42	3	81,900
* KC7PA	UT	299	43	7	77,000
* KD7SP	NV	266	44	10	75,330
* W5TTE	NM	257	44	11	74,800
WA6FGV	CA	317	39	4	69,445
KB9S	WI	268	44	6	68,500
* NS5Z	LA	258	44	5	64,435
W6ØKX/4	GA	192	43	12	61,600
W3ARK	PA	281	38	1	54,990
NB9P	IN	233	41	1	48,935
* KD8PT	WV	172	42	4	47,840
* WA2HFI/Ø	MN	215	38	4	45,990
WBØBHF	IA	186	45	3	45,120
* KB7M	WY	211	39	2	43,665
WA2YLY	NJ	182	38	5	42,075
AF1T	NH	200	36	4	41,000
* VE2YU	QUE	160	40	7	39,480
N5HFR	TX	153	42	4	37,260
* KS7T	MT	157	40	4	35,860
KB7WN	WY	166	41	1	35,070
WA5IYX	TX	134	40	8	34,560
* WØIZV	CO	143	44	2	33,350
* AGØM	ID	139	37	6	31,175
* NØCLV	KS	132	42	1	28,595
N8CEO	MI	124	43	2	28,350
NE6I	CA	125	37	5	27,300
KB6ATI	CA	179	25	3	25,480
WØNGB	MN	117	40	2	24,990
KB8KW	WY	117	41	1	24,780
W4WIJ	FL	112	39	4	24,725
VE2DTI	QUE	104	41	4	24,525
W8VEN	WV	111	37	5	24,360
N8BJQ/6	CA	104	30	9	23,400
NE2W	NY	93	30	11	22,260
* N5AFV	OK	107	38	2	21,800
* VE1BDT	NS	114	33	3	21,060
K8KUH	MI	100	36	2	19,380
N4GTU	VA	93	35	1	16,920
* W3SOH	VT	100	30	1	15,655
WK4F	FL	76	31	6	15,355
N4TG	TN	105	29	0	15,225
N4UH	NC	76	32	3	14,000
W4TWW	SC	58	36	6	13,440

ARRL INTERNATIONAL EME COMPETITION

November 2 and November 3
November 23 and November 24
Full 48-hour-UTC period each weekend

The object of this contest is to establish two-way communications via the earth-moon-earth path on any authorized amateur frequency above 50 MHz. Fixed or portable operation is permitted. However, stations operating outside their traditional call areas must indicate the call area being used. Stations may be worked only once per band regardless of which weekend contest period.

Contacts may be on CW or SSB but only one signal per band is permitted. Any transmitter, receiver, or antenna used to contact one or more stations under one callsign may not be used under any other callsign during the contest except for family stations where more than one call has been issued. In that case, contacts are valid only if the second callsign is used by a different operator.

There are no specific minimum terrestrial distances for contacts as long as all communications are copied over the moonbounce path, regardless of how strong or weak a nearby station's terrestrial signal may be.

Operating categories are broken down into single and multiband single operator, multi-operator, and commercial equipment stations. Single-operator stations must use only one person for all operating and logging functions, equipment adjustment, and antenna alignment. Single-band single-operator entries on 50, 144, 220, 432, and 1296-and-up categories will be recognized in awards offered. Contacts may be made on any and all bands without jeopardizing single-band status. Such additional contacts are encouraged and should be reported.

Multi-operator stations are those stations using two or more persons, including neighboring amateurs within one call area but with EME facilities for different bands on different team members' premises, as long as no two are more than 50 km (30 miles) apart. Multi-operator neighborhood groups cannot use the same callsigns at each location; all calls will be listed in the results.

Stations using equipment that is not amateur (such as a disk antenna for lab equipment owned by an institution or government agency) will have their scores listed separately in this category.

EXCHANGE:

For a valid contact, each station must send and receive both callsigns and a signal report in any mutually understood format plus a complete acknowledgement of the calls and report. Partial or incomplete QSOs should be indicated in your log, but not for contest credit.

SCORING:

Each contact counts 100 points. Multipliers are each US state and Canadian call area, plus each DXCC country worked on each band. Final score is the sum of the QSO points times the total multipliers from all bands.

AWARDS:

Certificates will be issued to the top five stations worldwide in each entry category. Additional awards will be issued where significant achievement or competition is evidenced. In addition, each station that successfully completes at least one EME contact during the contest period will receive a certificate commemorating that achievement.

ENTRIES:

All entries must be postmarked no later than 30 days after the contest and must include complete log data. Your summary sheet should show a band-to-band breakdown of QSOs and multipliers and include details of your station setup and a photo. Usual disqualification rules apply. Address entries to ARRL Headquarters at 225 Main Street, Newington CT 06111.

IPA CONTEST

CW—November 2
0600-1000, 1400-1800 UTC
SSB—November 3
0600-1000, 1400-1800 UTC

Sponsored by the International Police Association to enable participants to work for the Sherlock Holmes Award and trophy. The contest is open to all radio amateurs and SWLs the first weekend in November each year. Entry classes include single- and multi-operator stations as well as SWLs. Use all bands from 80 to 10 meters (without WARC bands). Each station may be worked once per band.

EXCHANGE:

RS(T), QSO number, "IPA" if IPA member, and state for USA stations.

FREQUENCIES:

CW—3575, 7025, 14075, 21075, 28075.

SSB—3650, 3775, 3800, 7075, 7100, 14295, 21295, 28575.

All frequencies ±25 kHz.

SCORING:

Every completed QSO counts one point, or five points if with an IPA member or club station. Multipliers are the number of DXCC countries and US states where IPA members are worked. Final score is QSO points per band multiplied by mulitplier.

AWARDS:

Certificates to the three highest scoring stations, both member and nonmember, amateur and SWL. Any radio amateur fulfilling the conditions of the Sherlock Holmes Award or trophy may apply with the contest log sheet without a GCR list. However, each SHA and SHT requires the normal award fee.

ENTRIES:

Entries must be postmarked no later than December 31 and addressed to: Anton Kohten DK5JA/DKØIPA, PO Box 40 01 83, D-1452 Kempen 1, West Germany. Official contest logs are available from the same address for 2 IRCs.

N9DHX/QRP	IN	76	35	0	13,300
K2SCV/5	TX	66	27	6	11,880
W9LYN	IL	49	23	4	6,615
NJ8L	OH	42	17	4	4,830
WA8GLF	OH	38	18	0	3,420
K8CV	MI	29	18	3	3,360
NS6Y	CA	30	16	1	2,635
N8AXA	OH	21	12	0	1,260
KY9F	IL	18	7	1	720
KA9GHT	VT	10	5	0	250

DX Single Operator:

**DJ3HJ	West Germany	316	7	84	284,375
* KL7U	Alaska	392	34	21	187,000
* K3WGR/VP2M	Montserrat	368	47	30	176,715
* I4AVG	Italy	183	1	48	89,180
KF7S/KL7	Alaska	417	1	13	58,310
* YV5JEA	Venezuela	142	36	19	48,950
* EA3CCN	Spain	136	9	27	47,340
* KF6ME/DU2	Philippines	200	4	20	45,960
* HR1FC	Honduras	161	37	5	34,860
* ZF2GO	Cayman Islands	128	42	4	30,590
* 4U1UN (HB9RS)	UN HQ	131	34	3	24,790
* AH6FL	Hawaii	116	23	9	20,480
YU3CK	Yugoslavia	85	0	24	20,200
LZ1KKA	Bulgaria	84	0	21	17,640
YV6BTF	Venezuela	62	28	12	16,800
LX1RQ	Luxembourg	82	0	19	15,580
JL1MWI	Japan	78	8	15	13,110
G3GUP	England	71	0	17	12,070
YU4EZC	Yugoslavia	57	0	20	11,400
JA9YBA (JA9VDA)	Japan	70	7	10	10,370
G4XTM	England	53	0	16	8,480
FE6BVB	France	35	15	10	6,375
JE4VVM	Japan	34	6	15	5,670
CT1TM	Portugal	34	0	13	4,420
OZ3ZK	Denmark	28	0	14	3,920
EA3PE	Spain	29	0	13	3,770
HL4CAE	Korea	55	0	6	3,300
EA3ELM	Spain	25	0	13	3,250
LZ1KOZ	Bulgaria	20	0	12	2,400
FE8WE	France	22	0	9	1,980
OK3YK	Czechoslovakia	23	0	9	1,035
JH1IAQ	Japan	16	4	8	1,680
PA3CEF	Netherlands	12	0	5	600
DL8AAM	West Germany	8	0	6	480
JA2BNN	Japan	8	0	5	400
JE1ARQ	Japan	8	3	2	275
OZ3KE	Denmark	6	0	3	180
JH3DEJ	Japan	3	0	3	90

W/VE Multi-Operator

**K3TUP	PA	1,381	55	29	597,240
* KY0S	CO	1,139	55	28	512,940
* WA4JXI	FL	990	57	32	468,585
* N4DDS	TN	1,151	54	12	385,770
* KS9O	IL	946	55	22	374,990
* W2ZQ	NJ	1,064	51	15	359,700
* WD5GSL	TX	905	52	21	342,005
K5LZO	TX	747	56	26	333,330
NC9F	IL	907	53	18	332,635
* WA6PVA	OR	701	53	21	280,090
W9UCW	IL	559	50	16	190,740
* N4FKF	IN	363	48	5	97,520
* WA6HRH	CA	183	43	11	52,110

DX Multi-Operator

**I4KDJ	Italy	490	2	65	327,630
* VK6IR	Australia	285	25	25	128,750
JA7YFB	Japan	92	15	23	19,075
JA2YKA	Japan	25	5	9	2,870

Multi-Op Participants

W2ZQ	KA2IEU, N2FFA, KD2EZ, WA2JZF, KD2JA, N2CBL, WB2IQV, KB1BD, KB2NB, WB2REM, and Karen.
K3TUP	K3TUP, KB8IZ, N3BJ
N4DDS	N4DDS, N4DRL, KA5TAG, WB9TKS, KA8GAF, WA4VTZ
N4FKF	N4FKF, KA9ORN
WA4JXI	WA4JXI, WA4SVO, K0OO
WD5GSL,	WD5GSL, WB0TEV, WD5ABC
K5LZO	K5LZO, KA5SBS
WA6HRH	KG6JC, KG6JE, N6KUY
WA6PVA	WA6PVA, NI7T, N7PGO
NC9F	NC9F, N9EEO, WB9IPW
KS9O	KS9O, NB9T, KA9DVY
W9UCW	WB9NUL, WA9MAQ
KY0S	KY0S, AD0O, N0EBM
I4KDJ	I4KDJ, I4JMY, I4YSS, I4OUT, I4ZNU, I4USC
JA2YKA	JF2DQJ, JR2GMC, JA9SSY, JI2NPL, and Mr. Asano
JA7YFB	JE7MLJ, JH0QNT, JN1RON, JR7JLU, JR7GYC
VK6IR	VK6IR, VK6DU

Check Logs: KW2J, K5GN, N0BQW

Disqualified: (late logs) Y32KE, Y37RA, Y54TA, Y23TL, Y43UC, Y23YK, Y34K; (excessive/incomplete entries) KA0QFY/4, K9JNB, KA4MTK, WA4BSN, WB0WHB; (excessive duplicates) WR4F

DELAWARE QSO PARTY
Starts: 1700 UTC November 9
Ends: 2300 UTC November 10

Sponsored by the Delaware ARC. Stations may be worked once per band and mode for QSO and multiplier credits.

EXCHANGE:

QSO number, RS(T), and Delaware county, ARRL section, or country.

FREQUENCIES:

CW—1805, 3570, 7070, 14070, 21070, 28070.
SSB—1815, 3975, 7275, 14325, 21425, 28650.
Novice—3710, 7120, 21120, 28120.

SCORING:

Delaware stations score 1 point per QSO. Multiply total by the number of ARRL sections and DX countries worked.

Others score 5 points per Delaware station worked. Multiply total by the number of Delaware counties worked on each band and each mode (maximum of 36 multipliers possible).

ENTRIES & AWARDS:

Appropriate awards will be given to the top scorers. In addition, a certificate to all stations working all three Delaware counties. If you work all three counties and want the WDEL Award, send two 22-cent stamps and an address label. Mail logs by December 15 to: Charlie Sculley AE3H, 103 E. Van Buren Avenue, New Castle DE 19720. Send an SASE for a copy of the results.

CQ WE CONTEST
1900 UTC November 9
to 0500 UTC November 11

This contest is open only to present and retired employees of Bell Operating Companies, Western Electric, AT&T, and subsidiaries of AT&T. For logs and complete rules, contact your local Interworks coordinator or Warren Coleman WD4NIT, AT&T Technologies, 6701 Roswell Road, Atlanta GA 30328; (404)-257-7394 (work).

INTERNATIONAL OK DX CONTEST
Starts: 0000 UTC November 10
Ends: 2400 UTC November 10

Participating stations work stations of other countries according to the official DXCC country list. Contacts between stations of the same country count only for multipliers but have no QSO point value. Each station may be worked once on each band. Use all bands, 160 through 10 meters, on phone or CW. Crossband or crossmode contacts are not valid. Operating categories include: A—single operator all bands, B—single operator one band, C—multi-operator all bands. Any station operated by a single person obtaining assistance, such as in keeping the log, monitoring other bands, tuning the transmitter, etc., is considered as a multi-operator station. Club stations may work in category C only.

EXCHANGE:

RS(T) and 2-digit number indicating the ITU zone. *Please note the ITU zones are quite different from the ARRL zones!* For a list and map of the ITU zones, send 2 IRCs to the entry address listed below.

SCORING:

Each QSO counts one point, or 3 points if with an OK station. Final score is QSO points times the total number of ITU zones worked on each band.

ENTRIES:

A separate log must be kept for each band and must contain the full date. The

THE CHATTERING RELAY

NEWSLETTER OF THE MONTH

Tom Weiss WA8VSY is the Editor of *The Chattering Relay*, journal of the Cuyahoga Falls Amateur Radio Club (Ohio). We picked the *Relay* as this month's winner based on its fresh way of looking at things that too often become bogged down in a newsletter—financial woes, meeting announcements, etc.

Without becoming sappy, Tom covers the essentials in a lighthearted, fun-to-read style that makes the *Relay* hard to put down. Congratulations, Tom, and congratulations to the entire Cuyahoga Falls club.

To enter your club's newsletter in *73*'s Newsletter of the Month Contest, send it to *73*, 80 Pine Street, Peterborough NH 03458, Attn: Newsletter of the Month.

73 magazine for radio amateurs

- WORLD CHAMPIONSHIPS -

BAND: ____________

MODE: ____________

DATE	(GMT) TIME	CALLSIGN	REPORT SENT	REPORT RECD	NEW MULTIPLIERS	QSO PTS

Band: ____________

Contest Call: ____________ State/Province/Country: ____________

Station Owner: ____________ Call & License Class: ____________

Address: ____________ State/Country: ____________ Zip: ____________

Equipment: ____________ Amplifier: ____________

Power Output: ____________ Watts Antenna(s): ____________

Operator Class: O Single Operator Station O Multi-operator Station

If Multi-op, Calls of Participants:

CONTEST SUMMARY

Total Contest QSOs ____________

Total QSO Points Earned ____________

Total US States Worked ____________

Total Canadian Provinces/Territories Worked ____________

Total Countries Outside the US & Canada ____________

Total Multiplier Points Earned ____________

TOTAL QSO POINTS X TOTAL MULTIPLIER POINTS = CLAIMED CONTEST SCORE

____________ X ____________ = ____________

I have observed all competition rules as well as regulations governing the operation of Amateur Radio in my country. My contest entry, as submitted, is true and correct to the best of my knowledge. I agree to be bound by the decisions of the contest committee.

DATE: ____________ SIGNED: ____________ CALL: ____________

Circle US States and Canadian Provinces worked

1	2	3	4	5	6	7	8	9	Ø	VE/VO
CT	NJ	DE	AL	AR	CA	AZ	MI	IL	CO	ALT
MA	NY	MDC	FL	LA		ID	OH	IN	IA	BC
ME		PA	GA	MS		MT	WV	WI	KS	LAB
NH			KY	NM		NV			MN	MAN
RI			NC	OK		OR			MO	NBRUN
VT			SC	TX		UT			NE	NFLD
			TN			WA			ND	NSCOT
			VA			WY			SD	NWT
										ONT
										PEI
										QUE
										SASK
										YUK

List DX Countries Worked

A sample log sheet (both sides) for 73's World SSB Championships. See below for rules and forms address.

log must contain in its heading the category of the station (A, B, or C), name, callsign, address, and band(s) used. Also show the total number of contacts, QSO points, multipliers, and total score. Each log must be accompanied by the following declaration: "I hereby state that my station was operated in accordance with the rules of the contest as well as all regulations established for amateur radio in my country, and that my report is correct and true to the best of my belief."

A certificate will be awarded to the top-scoring operators in each country and each category. The "100 OK" Award may be issued to stations for contacts with 100 OK stations, and "S 6 S" Awards or endorsements for individual bands may be issued to a station upon a written application in the log; no QSLs are required. Logs must be postmarked no later than December 31 and sent to: The Central Radio Club, PO Box 69, 113 27 Praha 1, Czechoslovakia.

VK VERSUS THE WORLD CW QRP CONTEST 0000 UTC November 16 to 2400 UTC November 17

This CW-only contest can be operated for either the full 48 hours or for any 24 consecutive hours during the contest period. Entry categories are QRP single operator, QRP multi-operator, and QRO single operator (all are multiband or single band). Stations may be contacted once per band per 24-hour period.

EXCHANGE:

RST and serial number from 001 to 999 (start again with 001 for more than a thousand contacts).

FREQUENCIES:

Operation will be on all bands from 160 meters through 10 meters (not WARC). The call will be CQ QRP.

SCORING:

Each contact shall score points based on the following: up to 1 Watt, 6 points; between 1 and 2 Watts, 5 points; between 2 and 3 Watts, 4 points; between 3 and 4 Watts, 3 points; between 4 and 5 Watts, 2 points; over 5 Watts, 1 point.

QRP stations are defined as power output not exceeding 5 Watts. QRO stations are defined as power output exceeding 5 Watts. QRO stations receive points only for contacts with QRP stations (no QRO-QRO contacts).

MULTIPLIERS:

Each contact in a different ITU zone counts as a multiplier on each band.

Field stations (erected the same day as the contest) using battery/solar/wind/hand-generated power earn a bonus multiplier (multiply the grand total score by 1.5).

AWARDS:

Certificates will be awarded to the highest scoring QRP single and multi-operator in each country/section and to the highest scoring QRO operator in each section. A certificate will also be awarded to the highest scoring CW Operators QRP Club member in each section.

ENTRIES:

Each logged QSO should include date, time (UTC), call, exchange, multiplier, power output, and points claimed. A separate log sheet should be submitted for each band. Grand total score is total points from all bands times total multipliers from all bands times bonus multiplier. All entries must have a summary sheet showing the calculation of the grand total score, name, callsign, address, and signature with a declaration that: "I certify that all entries in my contest log sheets are true and honest." Please provide a brief description of your station equipment and any comments/suggestions.

Entries are due by December 14, 1985, and should be addressed to Contest Manager, J. Elliott, 8 Queens Street, Rosedale, VIC 3847, Australia.

WORLD SSB CHAMPIONSHIPS

Announcing the January Classics—the 1986 running of the World SSB Championships! The first and only contests of their kind, these five (5) individual single-band events are world-renowned and amongst the most challenging events on the bands today. Winners of each contest determine the World Champion for 15-, 20-, 40-, 75-, and 160-meter single sideband:

January 11, 1986
0000-2400 UTC
5th 40-Meter World SSB Championship

January 12, 1986
0000-2400 UTC
5th 75-Meter World SSB Championship

0000 UTC January 18, 1986,
through 2400 UTC January 19, 1986
7th 160-Meter World SSB Championship

January 25, 1986
0000-2400 UTC
2nd 15-Meter World SSB Championship

January 26, 1986
0000-2400 UTC
2nd 20-Meter World SSB Championship

RULES AND FORMS:

Contestants are encouraged to use official contest forms. To obtain your own copy of the rules and each contest form, send an *SASE* to: *Contest Rules and Forms, Billy Maddox KA6JJK/3, 1162 Bayview Vista Drive, Annapolis MD 21401.*

HAM HELP

I am looking for installation and service data (including schematics) for a Telediealer 32T automatic dialer, model 32T-02, part number 201566-2, manufactured by American Telecommunications Corporation.

Sheldon Daitch
PO Box 8091
Greenville NC 27835-8091

I would like to purchase any of the following units, complete or in pieces: AN/UGC-74 TTY, R392/URR, R1121/TRC-87 (with manual), RT-712/ARC-105, 490T-1, ARC-159, GRC-168, AN/AIC-14, 18, OR 25, ARC-92, ARC-98, ARC-109, ARC-123, ARC-126, ARC-138, ARC-150, ARC-157, PRC-70, SRR-19, TRR-32, URR-69, URA-17, C-3940/ARC-94, PRC-74B, R1051D/URR, MT-2641/ARC-94, and MRC-95. Also, any of the following test gear: Tektronix 453 CRO, 454A CRO, 647A CRO, 184 time mark generator, any 5000-series plug-ins, Hewlett-Packard 180A CRO, 181A CRO, 141A CRO, 400E VM, 6266B PSU, 331A distortion analyzer. And a power supply which gives 120 V ac at 300 VA or more from 115 or 230 V ac.

Leroy Ritta
PO Box 102
St. Marys 5042
South Australia

SPECIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine *by the first of the month; two months prior to the month in which the event takes place. Mail to Editorial Offices,* 73 Magazine, *Pine St., Peterborough NH 03458.*

FEEDING HILLS MA
NOV 1

There will be a giant auction of radio/electronic/computer items by the Hampden County Radio Association on Friday, November 1, 1985, at the Granger School, Feeding Hills MA (intersection of Routes 57 and 187), beginning at 7:30 pm. Please bring items that you wish to sell and mark your name on each item. The sponsor will take a 10% commission on all sales. There is no admission charge. For further information, contact Ron Beauchemin at (413)-739-5228.

BRENHAM TX
NOV 1-3

A swapfest and garage sale will be held at the Washington County Fairgrounds in Brenham, Texas, from November 1 to November 3, 1985. Special-event station NS5N will operate on 21.125 and 21.360 MHz; a special QSL is available for an SASE. Send QSLs and inquiries to Gene Stanford KA5LEI, BARC, Box 44, Brenham TX 77833.

RICHFIELD MN
NOV 2

The Twin City FM Club will sponsor Hamfest Minnesota and Computer Expo on November 2, 1985, from 8:00 am to 3:00 pm, at Richfield High School, 7001 Harriet Avenue South, Richfield MN. Admission is $3.00 in advance, $4.00 at the door. FCC exams will be given. Talk-in on .16/.76. For more information, contact Clyde R. Green NØDVP, 5406 Zealand Avenue North, New Hope MN 55428, or the Twin City FM Club, PO Box 555 Minneapolis MN 55440.

STONE MOUNTAIN GA
NOV 2-3

The Alford Memorial Radio Club of Stone Mountain GA will sponsor Ham Radio and Computer Expo 85 (formerly the Stone Mountain Hamfest) on Saturday and Sunday, November 2-3, 1985, from 9:00 am to 5:00 pm on Saturday, and 9:00 am to 4:00 pm on Sunday. Admission is $5.00 at the gate, $4.00 in advance. FCC license exams will be given on both days. Talk-in on 146.16/.76 and 444.25. For further information or reservations, contact the Alford Memorial Radio Club, PO Box 1282, Stone Mountain GA 30086; (404)-476-2944.

SMALLEST US POST OFFICE
NOV 2-3

The Fort Myers Area Amateur Radio Club will operate a special-event station on November 2-3, 1985, from the US Post Office in Ochopee, Florida, the smallest Post Office in the US. Phone and CW activity will be on 20, 40, and 80 meters. For a picture postcard QSL, send your QSL and an SASE to the Fort Meyers Area Amateur Radio Club, PO Box 4814, North Fort Myers FL 33918.

WORKED ALL EL PASO
NOV 2-4

The annual Worked All El Paso Contest will be held from 1600 UTC November 2, 1985, to 0400 UTC November 4, 1985, on the 10-meter band. This contest is to assist operators outside of El Paso in contacting the 15 El Paso stations required for the WAE award. The WAE certificate has been issued since the mid-1930s. If you have 15 El Paso QSOs, any band or mode, submit your logs to the El Paso Amateur Radio Club, 2100 San Diego Avenue, El Paso TX 79930. *Don't* send money, SASEs, or stamps—there is absolutely no charge for this award.

NEWMARKET ONT
NOV 9

The York Region ARC will sponsor the ninth Newmarket Flea Market on Saturday, November 9, 1985, from 8:00 am to 2:00 pm, at the Huron Heights Secondary School, Newmarket, Ontario, Canada. Admission is $3.00, with children under 15 (accompanied by parents) free. Tables are $3.00 each and must be reserved in advance. Flea-market setup begins at 6:30 am. Talk-in on 146.52 (VE3YRA) and 147.825/147.225 (VE3YRC). For reservations or further information, contact Geoffrey Smith VE3KCE, 7 Johnson Road, Aurora, Ontario L4G 2A3, Canada; (416)-727-6672 evenings.

OWENSBORO KY
NOV 9

The Owensboro ARC will sponsor the ABC hamfest and computer show on Saturday, November 9, 1985, from 9:00 am to 4:00 pm, at the Chautaugua Center on Leitchfield Road, Owensboro KY. Dealer setup begins at 7:30 am. Admission is $3.00; tables are $3.00. VEC exams will be given. Talk-in on 147.81/.21. For further information, write the OARC, PO Box 231, Owensboro KY 42301; (502)-685-5292.

WEST MONROE LA
NOV 9

The Twin City Hams will hold a hamfest on Saturday, November 9, 1985, from 9:00 am to 4:00 pm, at the West Monroe Convention Center, North 7th Street, West Monroe LA. Swap tables are free. Exams will be given. Talk-in on 146.52 and 146.25/.85. For more information, contact Benson Scott AE5V, 107 Contempo Street, West Monroe LA 71291.

NORTH HAVEN CT
NOV 10

The Southcentral Connecticut Amateur Radio Association will hold its 6th annual indoor electronics flea market on November 10, 1985, at the North Haven Rec Center, Linsley Street, North Haven CT, from 9:00 am to 3:00 pm. 6-foot reserved tables are $10.00. Admission is $2.00. Talk-in on 146.01/.61. For more information or table reservations, send an SASE to Jerry Trichter WA1IUF, General Chairman, 136 Alden Avenue, New Haven CT 06515; (203)-389-4423 after 6:00 pm and (203)-934-2647 before 5:00 pm.

FT. WAYNE IN
NOV 10

The Allen County Amateur Radio Technical Society will sponsor the 13th annual Fort Wayne Hamfest on Sunday, November 10, 1985, from 8:00 am to 4:00 pm, at the Allen County Memorial Coliseum on Coliseum Boulevard (US 30), Fort Wayne IN. Admission is $3.50 in advance and $4.00 at the door. There will be 380 tables available—all indoors. Dealer setup begins at 5:00 am. Tables are $8.00 each. Premium tables are $20.00 each. Parking is $1.00. VE examinations will be given on Saturday, November 9, with advance registration only. For more information or reservations, contact AC-ARTS Hamfest, PO Box 10342, Fort Wayne IN 46851.

ROCKFORD IL
NOV 10

The Experimental Amateur Radio Society of Rockford IL will sponsor a hamfest on Sunday, November 10, 1985, at the Harlem Community Center, 900 Roosevelt Road, Machesney Park IL (just southeast of the Machesney Park Mall). Advance tickets are $3.00 (send SASE) or $4.00 at the door. Inside tables are $5.00 each. Talk-in on 146.01/.61. For further information, contact EARS, Inc., PO Box 4291, Rockford IL 61110.

VETERANS DAY
NOV 10-11

The Armored Forces Amateur Radio Net will operate special-event stations from 0000 UTC on November 10, 1985, to 2400 UTC on November 11, 1985, to commemorate Veterans Day. Member stations will operate on the following frequencies: Phone—3.870, 7.283, 14.325, and 21.375; CW—7.065. A certificate is available for contact with any member station. Send a #10 SASE to WB1DWR #90, 16 Berkely Circle, Newington CT 06111.

VETERANS WEEK
NOV 10-11

The Hamfesters Radio Club will operate special-event station K9WFN from 1500 UTC on November 10, 1985, to 0300 UTC on November 11, 1985, from the Robert K. Wade K9CDH Memorial Ham Shack at the Hines, Illinois, VA Hospital. Operation will be on 14.260, 7.60, 146.43 simplex, and 144.210 USB. For a certificate, send a QSL and a 9″ × 12″ SASE (if folds are OK, use a #10) to Hamfesters Radio Club, Inc., Chicago, c/o Robert K. Wade Memorial Ham Shack, Hines Veterans Administration Hospital, Hines IL 60141.

WESTWOOD NJ
NOV 16

The Stateline Radio Club of New York and New Jersey will sponsor the Stateline Hamfest on Saturday, November 16, 1985, beginning at 8:00 am, at the St. Andrews School, 120 Washington Avenue, Westwood NJ. Tickets are $3.00. Tailgating is $6.00 per space. Vendor space is $10.00 before October 31 and $13.00 afterwards. VEC testing will be available. Talk-in on 146.835 (K2LSA). For further information, contact Stateline Hamfest, Stateline Radio Club, PO Box 325, Montvale NJ 07656, or call Fred N2ATI at (201)-664-5320.

BILLERICA MA
NOV 23

The Honeywell 1200 Radio Club and the Waltham Amateur Radio Association will hold their annual amateur-radio and electronics auction on Saturday, November 23, 1985, beginning at 10:00 am, at the Honeywell Plant, 300 Concord Road, Billerica MA (Exit 27 off Route 3). Admission and parking are free. Talk-in on 147.72/.12 and 146.04/.64. For more information, contact Doug Purdy N1BUB, 3 Visco Road, Burlington MA 01803.

MILWAUKEE WI
NOV 24

The Milwaukee Repeater Club will sponsor the 6.91 Friendly Fest on Sunday, November 24, 1985, from 8:00 am to 4:00 pm, at Serb Hall, 51st and Oklahoma, Milwaukee WI. Tickets are $2.00 in advance and $3.00 at the door. 4-foot tables are $3.00 in advance and $4.00 at the door. For information or reservations, send an SASE to the Milwaukee Repeater Club, PO Box 2123, Milwaukee WI 53201, before November 11, 1985. Talk-in on 146.31/.91 and 146.52.

MASSILLON OH
NOV 24

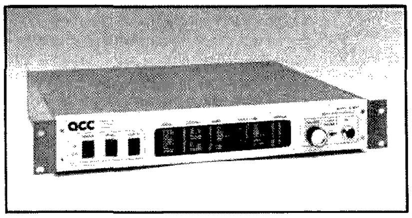
The Massillon ARC will sponsor Auctionfest 85 on Sunday, November 24, 1985, from 8:00 am to 5:00 pm, at the Massillon K of C Hall (off Route 21), Massillon OH. Seller setup begins at 7:00 am. Admission is $2.50 advance and $3.50 at the door. Tables are $7.00 per 8-foot space. The auction starts at 11:00 am. Talk-in on 147.78/.18 (W8NP). For advance registration or information, send an SASE to MARC, PO Box 73, Massillon OH 44646.

WIA 75TH ANNIVERSARY

The Wireless Institute of Australia, the world's first radio society, will celebrate its 75th anniversary during 1985. The WIA 75 Award will be available during the period from March 1, 1985, to December 31, 1985. To qualify, amateurs (and SWLs) need to contact (log) 75 members of the WIA. A contact will be valid only if the WIA member's individual membership number is logged. No more than 30 WIA members may be logged in any one callsign area. Send a log extract of the 75 members contacted and $2.00 (Australian) to WIA 75 Award Manager, Wireless Institute of Australia, 412 Brunswick Street, Fitzroy 3065, Victoria, Australia.

Holiday Shopping Guide

In the August edition of The 73 Bulletin *(our publisher's newsletter to advertisers), we invited our advertisers to display their wares in this Holiday Shopping Guide. While we realize that not everyone was able to participate (due to time constraints), we are happy to offer these suggestions for your holiday shopping.*



ACC's model RC-850 repeater controller.

ADVANCED COMPUTER CONTROLS

ShackMaster

Hook your home station into ShackMaster and enjoy the benefits of being in front of your equipment even when you're spending time with your family. Scan the bands, check into nets, DX, and rag-chew—all through your hand-held radio linked back to your shack. With ShackMaster's six basic features—crossband linking, telephone access, BSR shack control, electronic mailbox, ShackPatch, and PersonalPatch—you have all the power of your home station anywhere. Leave messages for your family (or they can leave messages for you), turn equipment on and off, or make emergency telephone calls. Base price: $695.00.

RC-850

The RC-850 repeater controller offers everything on your club's wish list. And its little brother, the RC-85 controller, fits comfortably in any group's budget. RC-85 base price: $895.50, RC-850 starts at $1237.50. For more information, contact *Advanced Computer Controls, Inc., 10816 Northridge Square, Cupertino CA 95014; (408)-749-8330.*

The CP-1 Computer Patch from AEA.

AEA

Hot Rod™ Antenna

The Hot Rod antenna by AEA was designed to provide maximum transmitting and receiving performance for a 144-MHz (model HR-1) or 220-MHz (model HR-2) hand-held transceiver. Unlike the many 5/8-wave telescopic antennas on the market today, the 1/2-wave Hot Rod antenna is short and light and provides more gain in practical applications. The AEA Hot Rod antenna is priced at $19.95 Amateur Net and is available from leading amateur-radio dealers.

Isopole™ Antenna

The Isopole antenna has proven to be one of the most effective omnidirectional vertical-gain antennas available for VHF and UHF use. With the maximum radiation directed on the horizon (at zero degrees elevation), little power is wasted at undesired angles. The Isopole was designed to eliminate rf spillover, which can seriously degrade the rf interference performance of any antenna, especially in the presence of computers having inadequate shielding.

For VHF packet communications, the Isopole is an ideal digipeater antenna with a great direct range. Packet radio generally involves computers or video terminals that generate rf "hash" in the shack. The superior decoupling of the Isopole will help eliminate this troublesome problem. No RFI induced on the coaxial feedline will be "spilled over" onto the antenna and hence into the radio. Nor will your transmitted signal be coupled back into the shack down the feedline, thus preventing untold problems with computer equipment. The pleasing space-age appearance of the Isopole will decorate any environment. Priced at $49.95 Amateur Net, the Isopole is available from most leading amateur-radio dealers.

AEA Model CP-1 Computer Patch™

The CP-1 Computer Patch is one of the most popular computer interfaces in use today. Any computer may be used with the CP-1 with the appropriate software. AEA offers special programs for the CP-1 that will work with Commodore VIC-20, C-64, SX-64, and C-128, Apple II, II+, or IIe, IBM PC or PCjr, and Heath/Zenith H-89 computers.

Variable shift control on the CP-1 allows the user to tune nonstandard RTTY shifts for monitoring signals outside the ham bands. The variable shift control can also be used as a passband tuning control to help eliminate heavy QRM.

The Computer Patch is supplied with a 117-V-ac power supply. AEA-SOFT™ software packages include premade cabling (except RS-232) for connection between the CP-1 and the respective computer.

The Computer Patch CP-1 is available (at $199.95 suggested Amateur Net) from leading amateur-radio dealers across the US and Canada.

For more information concerning these AEA products, contact *Amateur Electronic Applications, PO Box C-2160, Lynnwood WA 98036; (206)-775-7373.*

The Alinco ALM-203T 2m HT.

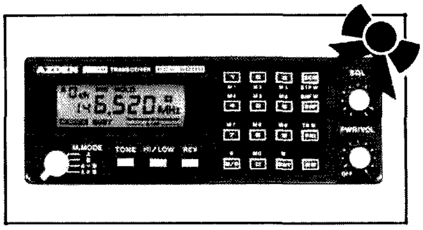
ALINCO

ALM-203T

Alinco has announced a new entry in the two-meter FM hand-held transceiver market. The new ALM-203T has many new and interesting features, some of which are unique. For example, the ability to transmit in the 144–148-MHz amateur band and receive between 140 and 160 MHz. There are ten memory channels, an LCD display, a small lamp to light the display at night, and a two-tone selectable subaudible CTCSS for private-line repeaters. Frequencies are entered by means of the keypad, and simplex/duplex operation with +/− offsets is available at the flick of a switch. Power output at 9.6 V dc is 3 Watts, and at 13.8 volts (standard) rf is 5 Watts. All standard accessories are available, and the unit comes complete with wall charger and NiCd battery pack at $345, list price. This unit soon will be followed by a two-meter mobile transceiver and a 440-MHz hand-held unit.

Dc Power Supplies

Alinco has introduced a quality power supply designed to compliment your station's appearance. These high-efficiency, high-output regulated supplies feature automatic current limiting and shutdown. Models range from 4.2 to 55 Amps. All supplies have outputs located on the front for easy access. There is a large meter for monitoring voltage and current. For more information, contact *Alinco Electronics, PO Box 70007, Reno NV 89570; (702)-359-1414.*



The Azden PCS-5000 from Amateur-Wholesale Electronics.

AZDEN PCS-5000 2M FM TRANSCEIVER

Amateur-Wholesale Electronics has announced the new Azden PCS-5000 2-meter microcomputer FM transceiver. The PCS-5000 has a frequency range of 140.000–152.995 MHz. This allows the unit to be used for CAP and all MARS frequencies. The radio is 2" high by 5½" wide by 7¼" deep.

The microcomputer facilitates features including up to 11 nonstandard splits, 20 channels of memory in which offset and PL™ information can be stored, dual memory scan, scan lockout in memory mode, two ranges of programmable band scanning with selectable scan increments, busy scan and delay scan in both the memory and band-scan modes, discriminator scan centering, priority memory with alert tone, state-of-the-art lithium battery for memory backup, repeater reverse, acquisition tone, programmable PL generator, and direct frequency entry.

The backlighted liquid-crystal display shows operating functions as well as frequency and S/rf bar-graph meter.

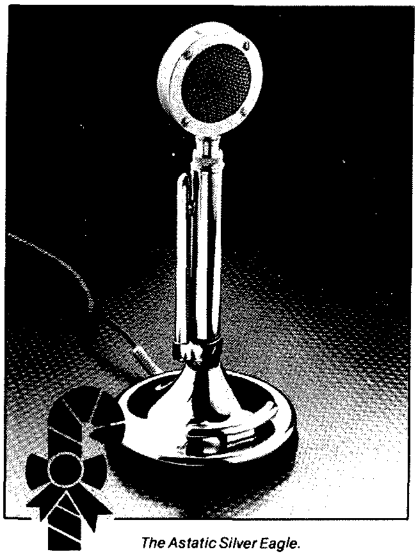
Other features of the PCS-5000 include high/low power (25 Watts and 5 Watts, fully adjustable), a receiver with superior sensitivity and dynamic range, true frequency modulation, a 16-key touchtone™ pad, a rugged multifunction dynamic microphone, a built-in speaker, mobile mounting bracket, remote speaker jack, and all cords, plugs, and fuses.

The PCS-5000 is distributed by *Amateur-Wholesale Electronics, Inc., 8817 SW 129 Terrace, Miami FL 33176; (800)-327-3102.*

ASTATIC SILVER EAGLE

Amateurs report that for best results on SSB, the D-104 is still the leader. As a matter of fact, Astatic exports more microphones to Japan than any other country for the same reason US hams use the D-104 on Japanese radios. The crystal element works like a crystal filter, only passing on to the speech processor and sideband filters those frequencies that allow these circuits to do their job. This provides the "DX audio" sought by so many hams.

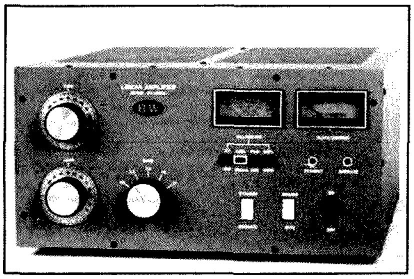
The most popular model, the Silver Eagle, is highly polished chrome and complements the appearance of any shack. The



The Astatic Silver Eagle.

Silver Eagle provides an emitter-follower impedance-matching amplifier so that it may interface with any transceiver.

For more information, contact *Astatic Corporation, PO Box 120, Conneaut OH 44030 0120; (216)-593-1111.* In Canada, contact *Canadian Astatic, Ltd., 1220 Ellesmere Rd., Unit 2, Scarborough, Ontario M1P 2X5; (416)-293-2222.*



B & W's model PT-2500A.

B & W HF LINEAR AMPLIFIER

The Barker & Williamson model PT-2500A is an HF linear amplifier designed for SSB, CW, RTTY, AM, or ATV operation on the amateur bands. The PT-2500A, using a pair of 3-500Z triodes, is a completely self-contained table-top amplifier capable of providing a full 1500 Watts of output. A pressurized plenum cooling system and a continuous-duty squirrel-cage blower ensure reliable and stable operation for extended periods of continuous use. The pi-network input circuit matches even the most finicky solid-state exciter. A pi-L tank circuit is incorporated for superior harmonic suppression. Designed originally by Viewstar, Inc., the PT-2500A will be manufactured by Barker & Williamson. The PT-2500A can be modified for frequencies outside the amateur bands for military or commercial use. The new PT-2500A will be available in early 1986.

For more information, contact *Barker & Williamson, 10 Canal Street, Bristol PA 19007; (215)-788-5581.*

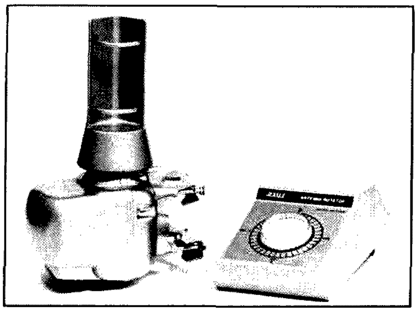
CMC COMMUNICATIONS

Docking Booster

A new idea to boost performance of your HT while mobile, the Docking Booster increases output power to 30 or 50 Watts and places the HT conveniently on the car door. A mike hang-up clip is provided. Most HTs need a front-end boost, too. The Docking Booster has a built-in GaAsFET preamplifier providing 16 dB of receive gain. Provisions are made to connect a roof-mount antenna and the car's 12-volt supply. Docking Boosters are available for most ICOM, Yaesu, and Kenwood radios only.

AR-200XL Antenna Rotor

Just dial in your desired heading and the rotor will turn and automatically stop when the heading is reached. The AR-



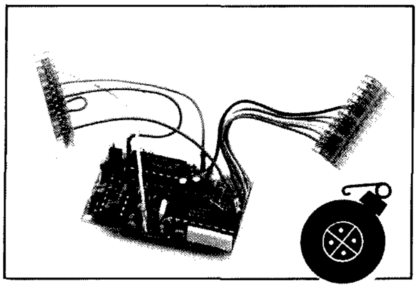
The AR-200XL antenna rotor from CMC.

200XL is a medium-duty rotor for your UHF and VHF arrays. Voltages are kept to 18 volts for safety, and only 3 wires are needed between the rotor and controller for simplicity and ease of installation.

Voice-Activated Squelch

Upgrade your new SSB transceiver with a voice-activated squelch. The VOS-1 is far superior on SSB to the all-mode squelch circuits supplied on most new rigs that simply operate from agc fluctuations. It is immune to noise, heterodynes, static crashes, and RTTY signals as it looks for certain components of the human voice before operating. Small enough to fit in most transceivers. Not a kit, completely wired and tested.

For further information, contact *CMC Communications, Inc., 5479 Jetport Industrial Blvd., Tampa FL 33614; (813)-885-3996.*



The TS-32JRC encoder-decoder from Communications Specialists.

COMMUNICATIONS SPECIALISTS PLUG-IN ENCODER-DECODER

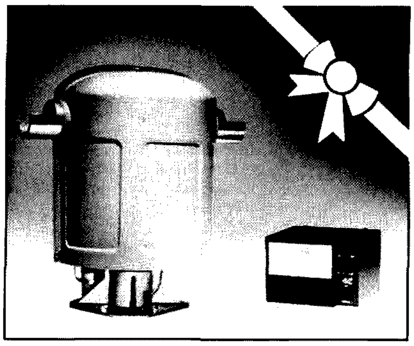
Communications Specialists has introduced another new direct plug-in encoder-decoder for three popular radios. The TS-32JRC is based on the proven TS-32 programmable encoder-decoder and plugs directly into the J.R.C. JHM-45S50, Sonar FM-2112/FM-2114, and Repco RSM. No modifications to the radios are necessary. The TS-32JRC allows individual selection of all 32 standard EIA CTCSS tones on any of the radios' 16 channels. The send and receive tones may be the same or different on each of the 16 channels. The TS-32JRC is available for immediate delivery from factory stock and sells for $62.95. For a catalog or more information, contact *Communications Specialists, Inc., 426 West Taft Avenue, Orange CA 92665-4296; (800)-854-0547, local (714)-998-3021.*

DYNETIC SYSTEMS DUAL-AXIS POSITIONING SYSTEM

Dynetic Systems Corporation has announced the availability of their new industrial-model DR10 dual-axis rotation system. Available for prompt delivery, the DR10 system provides both azimuth and elevation motion for camera lighting, microwave, or antenna-equipment loads (balanced) of 50 pounds or less.

The DR10 has undergone extensive testing in sub-zero conditions and is operating in other hostile environments with outstanding performance. Although aimed at light- to medium-duty systems, the rotator uses precision, industrial-grade gear motors manufactured by Dynetic Systems, which output 2000 inch-pounds of rated torque.

The DR10 features a dual-scale control meter, a self-contained ac power supply in the control unit, and a top-mount rotor which is serviceable without removing the equipment.



The DR10 dual-axis rotation system from Dynetic Systems.

For additional information, contact *Len Burgers, Marketing Manager, Dynetic Systems Corp., 19128 Industrial Blvd., Elk River MN 55330; (612)-441-4303.*

ETRON RF NOTES

RF Notes No. 2 is the second in a series of computer programs designed to aid in the design and development of rf systems and circuitry. The program series starts with basic topics and graduates into more sophisticated subject matter as the series progresses.

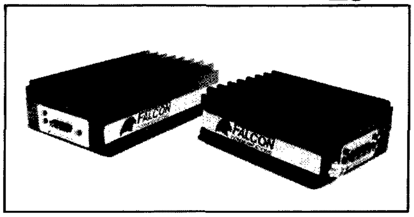
RF Notes No. 1 is a program which is a collection of basic RF Engineering notes from our engineering notebooks, reduced to program status. These notes can be quite useful in everyday *radio-frequency engineering questions.* The disk contains over 160K bytes of material in eight programs. The material is written in BasicA (or Cartridge Basic in the case of the PCjr) and is all menu-driven, in color, with error trapping. The computer environment is IBM PC-DOS or MS-DOS and 64K bytes of RAM minimum, color adapter required, and a graphics printer is suggested. (Other computers please inquire.) The price for RF Notes No. 1 is $57.00, plus $3.00 per program shipping and handling.

RF Notes No. 2 contains over 180K bytes of material and covers the following subjects:

- Attenuator pads: calculates circuit constants for 11 different pad configurations, to your specifications, all with schematic diagrams.
- Inductors: inductance of a single length of wire. Single-layer coils, both close-wound and space-wound. Includes automatic wire-size selection. Toroidal coil design. Includes automatic selection of wire size and toroidal form including manufacturer's part number. Includes mechanical and schematic diagrams.
- Capacitors: calculates self-resonant frequency, determines optimum values for bypass and decoupling applications. Equivalent circuit diagrams in schematic form are included.
- Impedance-matching networks: Using modem circuit theory, transformations with the L, pi, T, and series L networks are performed. There are 12 configurations, all with schematic-diagram data outputs.

RF Notes No. 2 is for the IBM PC, PC/XT, PCjr, and compatibles. The program is written in BasicA, in color (monochrome available), and requires 128K bytes of memory. The price for RF Notes No. 2 is $60.00 plus tax, plus $3.00 shipping and handling.

For more information, contact *Etron RF Enterprises, PO Box 4042, Diamond Bar CA 91765.*



Falcon Communications bipolar mobile amplifiers.

FALCON COMMUNICATIONS BIPOLAR MOBILE AMPLIFIERS

Falcon Communications offers a line of bipolar mobile amplifiers. Made in the USA, these amplifiers are all-mode (SSB,

CW, or FM) linear amplifiers mounted on large heat sinks for cool operation. Motorola rf power transistors are used for maximum reliability.

A carrier-operated relay is included and a remote keying jack is available on the rear panel. Built-in thermal protection places the unit in a straight-through mode in the event of overheating. It automatically resets when the unit cools down. An optional receive preamp is available for those users whose receivers need an extra boost. The two-meter versions of these amplifiers, all with a maximum power output of 150 Watts, are as follows: Model 5121—2 Watts in = 150 out, 1 Watt in = 90 out. Model 5122—10 Watts in = 150 out, 5 Watts in = 80 out. Model 5123—25 Watts in = 150 out, 10 Watts in = 75 out. Model 4109—optional plug-in preamp; 12 dB gain, 2 dB NF.

For more information, contact *Falcon Communications, PO Box 8979, Newport Beach CA 92658; (714)-760-3622.*

FOX-TANGO

Fox-Tango is known for the quality of their crystal filters, which are available for most of the popular ICOM, Yaesu, Kenwood, and other HF transceivers. For example, receiver selectivity may be improved through the use of 8-pole i-f filters as drop-in replacements for those in your transceiver. Included in the complete line of filters offered by Fox-Tango are 2.1-kHz (SSB) bandwidths, and 250-Hz or 500-Hz (CW) bandwidths. Complete instructions are included with each filter ordered, and discounts are available on multiple-quantity orders. For more information and a complete catalog, write *Fox-Tango, Box 15944S, W. Palm Beach FL 33416; (305)-683-9587.*

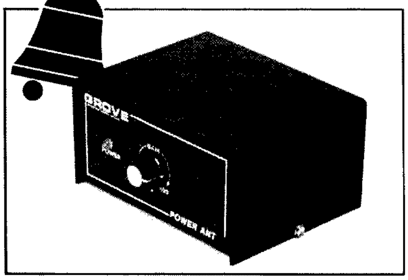
GLB ELECTRONICS

The GLB Model PK1-L is the first TNC designed for portables and solar-powered stations. Special features include:

- Low current drain—25 mA, 12 V dc
- Miniature size—4.6" × 5.8" × 1"
- Weighs 12 ounces including cabinet
- On-board lithium-battery RAM backup
- On-board "watchdog" for reliability
- Retains all features of the Model PK-1
- Standard DB25 connections
- 8K RAM—16K ROM
- Squelched audio not required

The Model PK1-L comes completely wired and tested in an all-metal shielded cabinet. List price: $239.95, Amateur Net: $209.95.

For more information, contact *GLB Electronics, 151 Commerce Parkway, Buffalo NY 14224; (716)-675-6740.*



The Power Ant Plus from Grove Enterprises.

GROVE ENTERPRISES

Power Ant Plus

With total-spectrum 100-kHz–1300-MHz coverage and up to 30 dB gain, this new Grove low-noise preamplifier can make a difference in longwave, shortwave, scanner, TV, and FM signal strength. Equipped with standard Motorola jacks for most scanner applications. We took our ANT-4B Power Ant and modified it for wider bandwidth and lower intermodulation so that it can cope with strong and weak signals alike. Use the front-panel gain control to boost weak, distant signals or to attenuate overload from strong local powerhouses. Price: $49.00 plus $2 UPS or $5 US mail.

Minituner III

This shortwave/longwave performance booster can eliminate images, intermod, and phantom signals on your shortwave receiver.

No power required; simply connect to your receiver's antenna and enjoy reduced interference reception from 100 kHz through 30 MHz. Price: $39.00, free UPS, $5.00 US mail.

Scanner Beam

The Grove Scanner Beam is an eleven-element log-periodic dipole array, designed to provide no-compromise directional reception from 108–512 and 806–960 MHz, and bi-directional reception from 25–54 MHz. It is made of durable heavy-gauge aluminum. With 15 dB of front-to-back ratio and 30 dB of side rejection, the Scanner Beam ensures maximum response to distant, weak signals, yet strong local signals may be received from all directions without the need for antenna rotation. Comes equipped with standard TV-type F connector for easy connection to low-loss 50- or 75-Ohm coaxial cable. Price: $40.00 plus $3.00 UPS, $6.00 US mail. For information or catalog, write *Grove Enterprises, PO Box 98, Brasstown NC 28902; (704)-837-9200; order desk, (800)-438-8155.*

Heath's SW-7800 general-coverage receiver.

HEATH

SW-7800 General-Coverage Receiver

The SW-7800 receiver covers 150 kHz through 30 MHz continuously in 30 overlapping 1-MHz bands. Broadband front-end circuits eliminate the need to tune circuits within a band and wideband front-end stages eliminate the need for the customary rf amplifier. An upconverting, double-conversion mixing design provides excellent image rejection.

The SW-7800 features a five-digit LED display with 1-kHz accuracy, LSB, USB, CW, and AM (wide and narrow) modes of operation, agc time-constant switch, synthesized high-frequency oscillator, and a muting provision to permit operation with a transmitter. Other features include a switch to protect against overload from very strong local stations, front-panel jack for taping receptions (unaffected by volume setting), and a telescoping whip antenna for local reception and portable operation. Only a VTVM is required for receiver alignment.

HD-3006 Crossfire Tuning Indicator

The new HD-3006 is a visual tuning indicator for RTTY communication. Sixteen LEDs make up the display: Eight vertical LEDs identify mark signal strength while eight horizontal LEDs do the same for space signal strength. Tuning the indicator for maximum vertical and horizontal display will provide a strong signal for computers or RTTY printers. Each LED bar requires approximately 14-dB no-signal-to-signal voltage ratio for full operation. Minimum input signal is 0.3 V ac rms or 0.5 V dc. Maximum signal is 15 V ac rms or 15 V dc.

The HD-3006 Crossfire Tuning Indicator has a wide voltage range and is compatible with almost any interface/terminal unit that has oscilloscope outputs for tuning. The ac/dc cube-type power supply is included in the kit.

Terminal Node Controller

The HD-4040 terminal node controller (TNC) has been added to the amateur-radio product lineup at Heath Company.

The HD-4040 is a version of the popular Tucson Amateur Packet Radio (TAPR) which allows communication using terminal or computer control of any amateur-radio system. Packet radio ensures error-free communication and greatly increases communication speed. The HD-4040 has a built-in 1200-baud modem. Baud rates of up to 9600 are possible with an external modem. Both AX.25 and VADCG protocols are used.

Three modes of operation are provided: a conversation mode which allows conversation with another operator, a command mode which allows configuration of the TNC and use of a variety of operating commands, and a transparent mode which is used in transferring files from one computer to another. A 6809 processor and a 32K ROM and 8K RAM are featured. Both ROM and RAM can be expanded by adding up to 16K.

A built-in automatic beacon can be set to transmit a message at designated intervals determined by the operator. Any station can act as a digital repeater and up to eight such "linking" stations are allowed, which greatly expand the operator's range.

For more information on these products, write to *Heath Company, Dept. 150-565, Benton Harbor MI 49022.* In Canada, write *Heath Company, 1020 Islington Avenue, Dept. 3100, Toronto, Ontario M8Z 5Z3.*

The IC-3200A dual bander.

ICOM

IC-3200A Dual Bander

ICOM has announced the IC-3200A 25-Watt compact full-featured dual bander. With only 14 front-panel controls, the IC-3200A offers these features:

- Frequency coverage: 2 meter (140.000–150.000 MHz), 70 cm (440.000–450.000 MHz)
- 5-kHz fully programmable offsets for MARS and CAP repeater operation
- 5½" W × 2" H × 8½" D
- 25 Watts output on both bands
- Memory lockout
- Scanning: memory, band, programmable, and priority
- Ten tunable memories with lithium battery to maintain memories when disconnected from the power source
- LCD display
- Tone encoder (all PL and subaudible tones built-in)
- One antenna connector (duplexer is already installed)
- Variable tuning increments: 5 and 15 kHz (2 meters), 5 and 25 kHz (70 cm)

The IC-3200A also comes standard with an IC-HM14 touchtone™ mike with up/down scan, dc power cord, and a mobile mounting bracket. Suggested retail price is $549.00.

IC-1271A 1.2-GHz Transceiver

ICOM has announced the IC-1271A full-featured base station transceiver. With coverage from 1240 to 1300 MHz, the IC-1271A features 10 Watts of rf output power, 32 memories, scanning, and multimode operation including ATV (amateur TV).

Additional features include:

- Front-end GaAsFETs
- CW/FM/upper and lower SSB
- Scanning—memory, program, or mode scan
- 12 V dc or 117/240 V ac (optional)

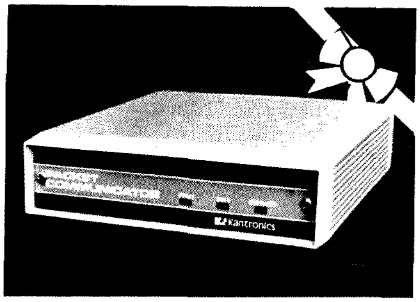
Options include the TV-1200 ATV interface unit, IC-EX310 voice synthesizer, UT-15S CTCSS encoder/decoder, and IC-PS25 13.8-V-dc internal power supply. Suggested retail price is $999.00. For more information, contact *ICOM America, Inc., 2380 116th Ave. NE, Bellevue WA 98004; (206)-454-8155.*

INTERNATIONAL RADIO

International Radio offers 8-pole crystal filters for ICOM 730, 735, 740, 745, 751, R70, R71, and R7000:

- Drop-in 2.1-kHz SSB, 9.0115-MHz center frequency (CF), replaces FL-30—$49.00
- Drop-in 2.4-kHz SSB, 455.00 CF, replaces FL-44 exactly—$80.00
- Wire-in 2.1- kHz SSB, 455.00 CF, replaces FL-44—$99.00
- Drop-in 400-Hz CW, 9.0106 CF, replaces FL-32—$49.00
- Matched set SSB 2.1 kHz—$139.00
- Matched set CW 400 Hz—$139.00

For more information, contact *International Radio, Inc., 1532 SE Village Green Dr., Suite L, Port St. Lucie FL 33452; (305)-335-5545.*



Kantronics Packet Communicator.

KANTRONICS

Universal Terminal Unit

Kantronics has announced a new concept in computer-to-transceiver interfacing. The Kantronics Universal Terminal Unit (UTU) gives any computer with an RS-232 port and a terminal program the ability to interface with any transceiver. The need for additional programs has been eliminated with the inclusion of a microcomputer in UTU. The internal programming of UTU allows reception and transmission of Morse code, radioteletype, ASCII, and AMTOR.

To access the internal program a terminal program is used. The terminal program is usually very similar to the program used for telephone modem operation. The manual shipped with the Kantronics UTU includes terminal program examples for IBM, Kaypro, Radio Shack TRS-80 Models III and IV, and many other popular computers.

The UTU gives the operator the freedom to program additional features or to use the system in its standard format.

The Universal Terminal Unit is housed in a precision extruded aluminum alloy case. The ten-segment LED bar graph is used for tuning, and individual LEDs show lock and valid status during AMTOR operation. UTU requires 12 volts dc, 200 mA minimum, and the user must provide the power supply.

The internal menu driven UTU program allows transmission and reception of CW at 6-99 wpm, radioteletype at 60, 67, 75, 100, and 132 wpm, ASCII at 110, 150, 200, and 300 baud, and AMTOR modes A, B, and L. These capabilities give the operator the opportunity to communicate in four different coded amateur formats. Suggested retail price: $199.95.

Packet Communicator

To better utilize the new packet technology, Kantronics has designed a new hardware format for processing the packet protocol. By using an internal microprocessor to handle the protocol and integrated circuits for signal processing, the Kantronics Packet Communicator becomes the most compact and inexpensive finished packet unit available today.

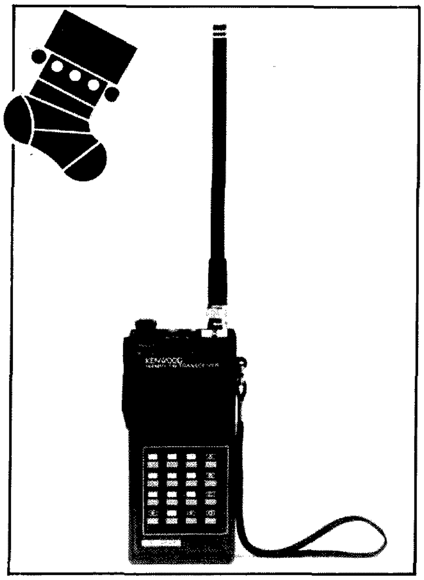
Data is transmitted between the Kantronics Packet Communicator and the computer using a serial RS-232 or TTL port. Baud rates of 300, 1200, and 9600 can be used. Any terminal or communications software program, like those used for telephone modem operation, can be used to set up the computer to communicate with the Packet Communicator. Special Packet Terminal (Pac-Term™) programs for many popular personal computers will be available soon from Kantronics.

System compatibility, the ability to exchange data with existing packet terminal node controllers, has been achieved with the Kantronics Packet Communicator by using the popular Tucson Amateur Packet Radio group software program. Almost all of the commands and operation procedures used by the TAPR group are used with the Kantronics Communicator. Both the ARRL standard AX.25 and Vancouver protocols are incorporated in the unit. The Kantronics Packet Communicator supports baud rates of 300, 400, 600, and 1200, but the unit does not support full-duplex operation.

An added feature of the Kantronics Packet Communicator is the ability to select either Bell 103 or 202 tones for 300-baud operation. This will allow the operator to switch to the lower tone set, improving performance at slower speeds on the HF bands. This feature makes the Kantronics Packet Communicator an excellent choice for gateway use on the HF bands.

The Kantronics Packet Communicator will also function as an intelligent 1200-baud radio modem. This feature gives the operator the ability to transmit and receive data at high speeds without using any special protocol.

The unit is housed in an extruded aluminum case measuring 1.9" H × 5.9" W × 8" D. An external power supply and cables for connection to the transceiver and computer are included. The user must provide the RS-232 and microphone connectors for his station. The Kantronics Packet Communicator is not available in kit form. Suggested retail price: $219.00. For more information, contact *Kantronics, 1202 E. 23rd St., Lawrence KS 66046.*



The TH-21AT from Kenwood.

KENWOOD

TH Series HTs

- High/low power switch (1 Watt high, 150 mW low)
- TH-21A and TH-21AT have expanded frequency coverage for most MARS and CAP frequencies (141.000-150.995 MHz)
- TH-31A/TH-31AT: 220.000-224.995 MHz in 5-kHz steps
- TH-41A/TH-41AT: 440.000-449.995 MHz in 5-kHz steps
- Repeater offset switch
- Quick change, locking battery case
- Comes complete with rubber flex antenna, 180-mAh battery, wall charger, and wrist strap

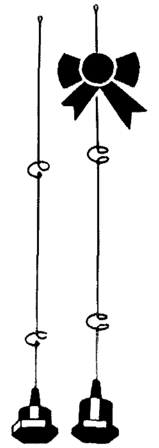
TS-430S Compact HF Transceiver

- 150-kHz-30-MHz general-coverage receiver
- I-f shift
- Tunable notch filter
- LSB, USB, AM, CW, FM (optional)
- Programmable, multi-function scanning
- 8 memories, with memory channel 8 for split-frequency operation
- Built-in speech processor

TS-940S HF Transceiver

- 100% duty cycle transmitter (14,150 kHz, CW mode, 110 W, 60 mins.)
- Built-in FM
- 40 memory channels
- General-coverage receiver, 150 kHz-30 MHz
- Direct keyboard entry of frequency selection
- Exclusive multi-function LCD panel that graphically illustrates CW VBT, SSB slope tune, frequency, time, and antenna-tuner status (when AT-940 installed)
- Automatic antenna tuner built in (covers 160-10 meters)
- Semi or full break-in (QSK) CW
- Pan display capability (when SM-220 equipped with BS-8)
- SSB slope tuning, CW VBT, notch filter for interference reduction
- Voice synthesizer option (VS-1)
- Dynamic range exceeding 102 dB

There is a full line of optional accessories available for these products. For more information, contact *Trio-Kenwood Communications, PO Box 7065, Compton CA 90224; (213)-639-9000.*



The 1290 antenna series from Larsen.

LARSEN ELECTRONICS

Self-Resonant Antenna for Portables

The new Larsen KD14-440-HW (440-450 MHz) is a half-wave design that is resonant despite the poor ground plane provided by the portable. It is 12" long and fits any radio with BNC output. Suggested retail price is $32.50.

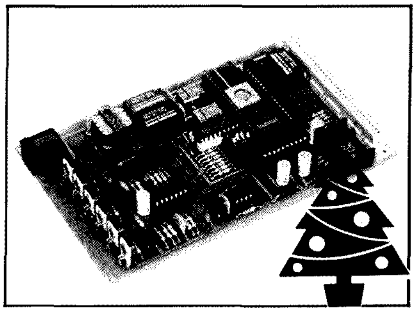
The 2/70 Antenna Series

These antennas are for operation on VHF and UHF frequencies. One antenna covers both frequencies without tuning. By combining ⅝- and ½-wave elements, one antenna covers 2-meter (144-148 MHz) and 70-cm (440-450 MHz) amateur frequencies. They operate with or without a ground plane. Units available to fit Larsen NLA, NMO, and PO mounting hardware. Suggested retail price is $45.22 each.

The 1290 Series for 1.2-GHz Use

The design of this series combines 2 half-wave elements fed by a quarter-wave element with integral phasing. They deliver a full 5 dB gain when compared with a quarter-wave antenna mounted in the same location. Low-loss mounting kit is available for both Larsen NMO- and NLA-style mounting. Suggested retail price is $26.12.

For more information, contact *Larsen Electronics, 11611 NE 50th Ave., PO Box 1799, Vancouver WA 98668; (206)-573-2722.*



The HPC201B microcomputer controller from Maggiore.

MAGGIORE

HPC201B Microcomputer Controller with Autopatch

The HPC201B is a computerized repeater control system with all these features:

- User programmable key code and autopatch codes
- Intelligent autopatch
- Programmable courtesy tone
- User-controlled toll restrict
- Up to 7 individually controlled 500-mA outputs
- Valid tone acknowledgement with LED
- Smart identifier, user-programmable
- Input status indicators
- Input and output amplifiers
- Mating connector

- Size: 3⅞" W × 6½" L × ⅞" H
- Multi-digit programmable command and autopatch codes
- Reverse autopatch and repeater telephone control
- Burglar-alarm input
- Tone muting
- Tone masking
- Three-speed rotary dialer
- 911 capability
- Redialer
- Up to 60 different functions
- 16-digit decoder
- Auxiliary or link input
- LED indicator outputs
- Uses single 12-volt power supply
- Easy repeater connections
- Sockets used on all ICs
- Source listing available

Hi Pro "E" Expandable Repeater System

The Hi Pro "E" is an expandable repeater system with the following features: a basic repeater which would include a complete receiver, transmitter, COR, front-panel controls, indicators, local speaker, and mike jack. The Hi Pro "E" is housed in an enclosed, 19" rack-mountable cabinet.

This system can be expanded at the time of purchase, or one can obtain after-purchase add-ons when required, such as a higher-power, 110/220-volt-ac power supply, identifier, autopatch, or computer controller. In addition to these add-ons an additional receiver and transmitter can be mounted internally for such uses as control-link, remote-base, or dual-band operation, etc. An extension panel is available for local monitoring of the repeater with a control cable that plugs directly into the rear of the repeater. This panel contains all necessary metering, status lights, and indicators. All add-ons to expand the system will be available from the company and are complete including instructions for proper installation.

For more information, contact *Maggiore Electronic Laboratory, 590 Snyder Avenue, West Chester PA 19380; (215)-436-6051.*

GLEN MARTIN ENGINEERING

Glen Martin Engineering, Inc., will soon be releasing a new line of steel towers that are truly self-supporting in 100-mph winds and handle antenna loads ranging to 30 square feet at heights to 300 feet.

The tower has an equilateral triangular design with face width ranging from 16" to 6'. There are tapered as well as straight sections. Material is hot-dipped galvanized steel and all bolted constuction. For more information, contact *Glen Martin Engineering, Inc., PO Box 253, Boonville MO 65233; (816)-882-2734.*

The MFJ Mobile Antenna Matcher.

MFJ ENTERPRISES

MFJ-949C Deluxe Versa Tuner II

The new MFJ-949C Deluxe Versa Tuner is a completely new design with improvements over the 949B. It has a cross-needle meter that reads forward power, reflected power, and swr simultaneously in either 300 or 30 Watts, with no swr sensitivity adjustment needed.

Providing maximum power transfer from your transmitter to nearly any antenna, the unit can handle up to 300 Watts rf output from the transmitter from 160 through 10 meters. A three-inch-diameter air-wound inductor gives plenty of matching range and less loss for more Watts out. The 6-position antenna switch allows selection of: two coax lines (direct or through the tuner), random wire or balanced line, and dummy load. For balanced lines, a 1:4 balun is built into this unit.

The MFJ-949C also includes a 50-Ohm dummy load, 1000-volt capacitors, and SO-239 connectors and binding posts for balanced line, random wire, and ground.

Measuring 10 × 3 × 7 inches, the unit can be used with any transmitter and antenna, home or mobile. It retails for $149.95.

MFJ-815 Cross-Needle Swr/Wattmeter

A cross-needle swr/wattmeter enabling ham operators to read swr, forward, and reflected power at a single glance is now available. No swr setting is needed at any range.

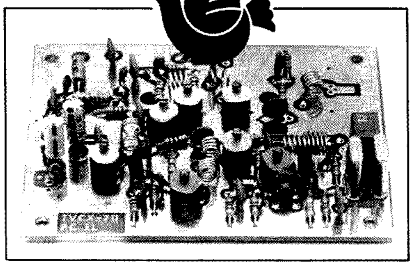
The average forward and reflected power can be read in three ranges: 20/200/2000 Watts forward and 5/50/500 Watts reflected. Swr can be read from 1:1 to 1:5 on a two-color scale. The unit works from 1.8 to 30 MHz, and accuracy is ± 10% full scale. Ranges are push-button selected. It sells for $59.95.

MFJ-910 Mobile Antenna Matcher

The MFJ-910 is a Mobile Antenna Matcher which lowers swr by capacitive matching a mobile antenna to 50 Ohms; more power results out of the transmitter and into the antenna, especially if a solid-state rig is being used. The MFJ-910 matches mobile antennas for 10 through 80 meters. It measures only 2½" × 2½" and can be mounted inconspicuously with the mounting holes provided. Installation is simply the connecting of the antenna to the SO-239 connector labeled "out" and the transmitter to the SO-239 connector labeled "in."

The Mobile Antenna Matcher retails for $19.95.

All MFJ products come with an unconditional 1-year warranty, and items bought directly from MFJ have an additional 30-day guarantee. If not completely happy with your product during that time, it may be returned for a full refund minus the shipping and handling charge. For further information, call *(800)-647-1800 or write to MFJ Enterprises, Inc., PO Box 494, Mississippi State MS 39762.*



P. C. Electronics' crystal-controlled version of its downconverter.

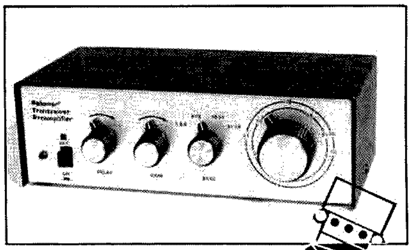
P. C. ELECTRONICS' DOWNCONVERTERS

Dual-gate GaAsFETs in the preamp and mixer stages make the P. C. Electronics TVC-4Ga GaAsFET 70-cm ATV downconverter a very sensitive unit which will dig out the weakest video from the snow. The high-Z, double-tuned bandpass filter as well as the GaAsFETs' high resistance to intermod really reject strong UHF TV broadcast and other out-of-band signals. The active mixer has the same dynamic range as a doubly-balanced mixer but with gain and low noise figure. A varicap-tuned vco covers the whole 420-450-MHz band with just enough overlap for the downconverter to output to your TV on any open channel from 2 to 4.

The TVC-4Ga can be powered by any external 12-V-dc power supply or by the 120-V-ac/12-V power supply that comes with it. Antenna input is a BNC and the TV output is a type F. The cabinet is 4" × 2.5" × 7". The unit is $109.00 delivered.

Those who want to package their own downconverter for the shack or antenna mount can get the wired and tested board (TVC-2Ga) by itself for $69.00, and there is the crystal-controlled version (TVCX-70) designed for unattended operations such as repeaters, links, and public-service events. It comes as a wired and tested circuit board set up to your specified input frequency and output TV channel. Requiring 12 V dc, it is $89.00 delivered.

For further information, call or write *P. C. Electronics, 2522 Paxson Lane, Arcadia CA 91006; (818)-447-4565.*



Palomar's P-410X preamplifier.

PALOMAR ENGINEERS

Transceiver Preamplifier

A new addition to the line of preamplifiers is the model P-410X, featuring improved selectivity and faster send/receive switching. It connects between transceiver and antenna, providing more than 20 dB extra gain and a low noise figure. Gain is continuously variable. An rf-sensing circuit automatically bypasses the preamplifier during transmit. The fail-safe switching circuit handles transceivers to 350 Watts PEP. Connectors are SO-239.

Universal Audio Filter

The new model FL-4 is for SSB/CW/RTTY/AM and features switched capacitor filters. A 10-pole low pass and an 8-pole high pass can be moved anywhere in the 200-3500-Hz voice range to form a sharp bandpass filter at any frequency and of any bandwidth. A notch filter eliminates heterodynes. It connects between receiver and speaker. The on-off switch bypasses the filter when not in use. For 15 V dc. An optional 115-V-ac adapter is available.

New High-Power Balun

The "Big Beam" balun has been optimized for the 7-30-MHz range. This new model BA-2000 has improved balance and swr across the range. The power rating is 2000 Watts output power through the balun with a good safety factor. It has been tested and works well at 5000 Watts. The BA-2000 is recommended for beams on 40, 20, 15, and 10 meters when high power is used. 1:1 ratio.

For further information on any of these items, contact *Palomar Engineers, Box 455, Escondido CA 92025; (619)-747-3343.*

PROTOPIC

Dave Smart has formed Protopic (prototype printed circuits) which specializes in fabbing PC boards for the prototyper, entrepreneur, or hobbyist. The company can turn out the first and second of a single- or double-sided PTH board for roughly half the cost charged by most production shops. The company also designs boards, prepares artwork, and stuffs boards to customer needs. For more information, contact *Protopic, PO Box 9853, Berkeley CA 94709; (415)-843-1326.*

NEW CALLBOOKS

Announcing the biggest change in its 65-year history, Radio Amateur Callbook, Inc., presents three new publications for 1986. The *North American Callbook*, the *International Callbook*, and the *Callbook Supplement* will provide current QSL information for over 880,000 radio amateurs throughout the world.

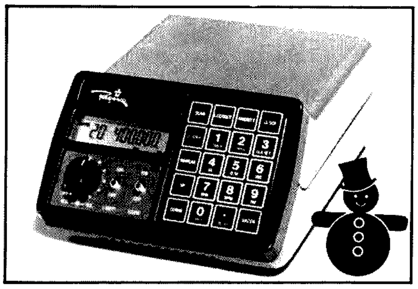
To be published on December 1, 1985, the new 1986 *North American Callbook* lists the licensed amateurs in all countries in North America plus those in Hawaii and US possessions. Not just a reprint of government licensing records, this listing information is carefully screened and corrected by our own editorial staff to ensure the utmost accuracy. Also featured are the *Callbook* extras: international postal information, worldwide QSL bureaus, and a census of radio amateurs around the world.

Also to be published on December 1st, the *International Callbook* lists the calls, names, and address information for licensed amateurs in all countries outside North America. Fully updated by the editorial staff using information from official sources throughout the world, coverage includes Europe, Asia, Africa, South America, and the Pacific area (exclusive of Hawaii and the US possessions).

The 1986 *Callbook Supplement* is a whole new concept in updates. To be published June 1st, the new supple-

ment will list the combined activity in both callbooks for the preceding 6 months. One supplement, available from your local dealer or the publisher, will bring you thousands of new licenses, address changes, and "then and now" call changes from countries around the world.

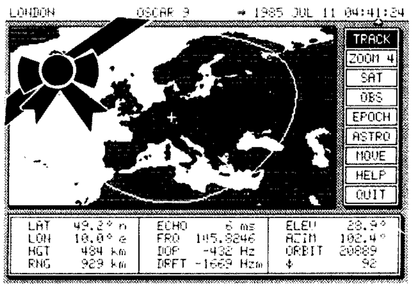
For additional information or literature, contact *Radio Amateur Callbook, Inc., 925 Sherwood Drive, Box 247, Lake Bluff IL 60044.*



Regency's MX7000 scanner.

REGENCY ELECTRONICS SCANNER REACHES 1.3 GHZ

In addition to monitoring all frequencies between 25 MHz and 550 MHz, the Regency MX7000 is one of the few scanners that can cover frequencies as high as 1.3 GHz. The scanner can monitor up to 20 channels or search through an entire band for an active new frequency. Other features include a 24-hour digital clock, priority channel, dual scan speeds, and scan or search delay. The MX7000 is designed for home or mobile use; a suggested retail price of $699.95 includes telescoping whip antenna, ac power supply, dc power cord, and a mobile mounting bracket. Complete details are available from suppliers or *Regency Electronics, Inc., 7707 Records Street, Indianapolis IN 46226.*



Silicon Solutions' GrafTrak II.

SILICON SOLUTIONS

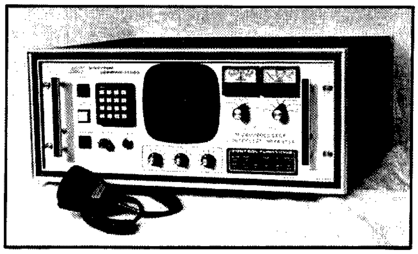
GrafTrak II

GrafTrak II provides real-time graphic display of a flat projection map which moves under the selected satellite/sun/moon/star coverage circle and updates once per second. Spherical projection views as well as graphic screen dumps to your Epson/Oki printer can also be produced. Requires an IBM PC, PC/XT, or true compatible, an IBM Color/Graphics Monitor Adapter, 8087 math coprocessor, minimum 256K RAM with 512K recommended, DOS 2.0 or later, and either two 360K floppy drives or one 360K floppy and one hard drive.

Silicon Ephemeris

Silicon Ephemeris provides tabular data output to the screen, printer, or disk file for the following operating modes: 1 observer to 16 satellites, 16 observers to 1 satellite, schedule for 1 observer to 1 satellite, window between 2 observers and 1 satellite, rise and set times for 1 satellite, time-ordered rise and set times for 16 satellites, almanac for sun and moon, 16 observers to sun/moon, schedule for 1 observer to moon, window between 2 observers and moon, schedule for one observer to sun. Requires an IBM PC, PC/XT, PC/AT, PC/jr, or true compatible, either an IBM Monochrome or Color/Graphics Monitor Adapter, an optional 8087 math coprocessor, 256K RAM, DOS 2.0 or later, and 360K floppy drive.

Each package includes SED, an editor program to construct and modify satellite/observer database files. These products can be run from a hard disk and are not copy protected. GrarTrak II and Silicon Ephemeris are priced at $119.95 each or $199.95 for both. For more information, contact *Silicon Solutions, Inc., PO Box 742546, Houston TX 77274-2546; (713)-661-8727.*



Spectrum Communications' SCR2000X microprocessor-controlled repeater.

SPECTRUM

Repeater/Base VHF and UHF Power Amplifiers

The Spectrum SCA 100 150-W VHF and 100-W UHF high-power amplifiers can be used with any 10-40-Watt transmitter, repeater, or base station. They feature: automatic high vswr shutdown/bypass mode with 4X automatic reset circuit, and auto amp bypass if the power supply should fail or if the amp should overheat. The 100-Watt UHF version is available for 420-450 MHz; 150-Watt VHF for 144-148 MHz. 19" rack mount. A heavy-duty companion power supply, the SCP30, is also available. Its ratings are 13.8 V dc out at 25 Amps, 100% continuous duty.

SCR2000X Microprocessor-Controlled Repeater

The repeater includes the following features:

- Full autopatch and touchtone™ repeater remote-control capability. Patch agc for constant levels.
- Phone line and over-the-air command modes
- Up to 13 autodial phone numbers
- Touchtone-to-dial-pulse converter
- Full 16-digit decoding with crystal-controlled decoder IC allows the use of A, B, C, and D characters in control codes. This expands the number of possible codes and increases security.
- Touchtone control of all important repeater functions: timeout, hang time, patch timeout, transmitter inhibit/reset, patch and reverse patch inhibit/reset, PL™ on/off (with optional PL board), etc.
- Up to 6 auxiliary functions—expandable
- Built-in muting circuit prevents retransmission of control tones
- Automatic CW ID and remote ID command
- Distinctive courtesy tone
- "Kerchunk Killer" circuit discourages annoying keyups
- Timeout warning tone
- Built-in battery backup saves microprocessor memory in case of power failure
- The following transmitter options are available: 2 M, 30 or 75 Watts; 220 MHz, 30 or 65 Watts; 440 MHz, 40 Watts. High-power rack-mount repeater power amps and power supplies are available to 150 Watts.
- A high-performance receiver is included, with high sensitivity, selectivity, and wide dynamic range. An 8-pole front-end filter is standard as well as a 12-pole i-f filter. "Super sharp" filter options are also available.

SCR77D Desktop/Portable Repeater

The SCR77D is a new desktop/portable repeater. Its compact, low-power design makes it ideal for local use (within a 0-20-mile radius, depending on antenna and terrain). It may be used at a fixed location, or portable/mobile. Autopatch and PL are available built-in. Ac power supply is built in, plus jacks for 12-V-dc power. Full-duplex base-station applications, such as computer data links or export "rural telephone," are also ideal for the SCR77D. Standard models include a 10-Watt UHF unit with built-in duplexer and a 15-Watt VHF unit with external duplexer. For more information, contact *Spectrum Communications, 1055 W. Germantown Pk., Norristown PA 19401-9616; (215)-631-1710.*

H. STEWART DESIGNS

DX Quickshift Antenna Mount

Mount on side or roof of motor vehicles or trailers. It takes antennas with ⅜" mounting studs. Raise or lower antenna with a 90-degree turn of one hand; it locks in position but it is easy to unlock and turn. All coax connections are sealed behind O-rings, weather and corrosion proof. Cost is $59.95, shipping paid, with all attachment hardware.

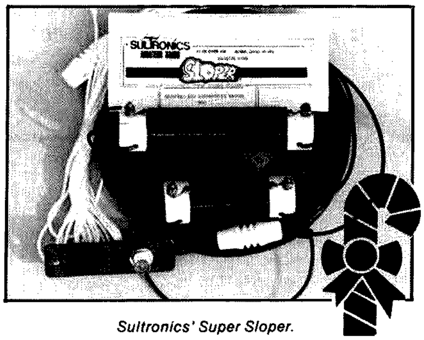
DX Hidden-Asset Loop Antenna

For those who can't have a visible antenna, this full-wave loop, omnidirectional, fits in a cylindrical space (vertically polarized) about 0.1λ high by about 0.125λ in diameter. It is broadbanded, swr 1.2:1 or less at resonance, and power handling up to legal limits. It feeds directly with 50-Ohm coaxial cable. Complete plans are $12.50; plans with complete pre-cut kits, shipping paid, are: 2 meter—$39.95, 6 meter—$47.95, 10 meter—$54.95, and 15 meter—$67.95. Prices on request for other frequencies.

II DX Two-Element Directional Antenna

These made-to-order full-wave loops mount in a very small space. Gain 5 to 7 dB over a single element, excellent rejection, bandwidth at least 3 percent of resonant frequency. When vertically polarized, they will rotate in a cylindrical space 0.25λ high by 0.16λ in diameter. Direct feed with 50-Ohm coax, tunable for radiation pattern/gain, and for frequency. Prices for kits and assembly instructions on request; specify frequency(ies).

For further information on any of these items, write to *H. Stewart Designs, PO Box 643, Oregon City OR 97045.*



Sultronics' Super Sloper.

SULTRONICS

The Super Sloper

The Sultronics Super Sloper covers 40, 80, and 160 meters and is only 60 feet long. It is as good a DX antenna as it is a low-angle radiator. It requires a mounting height of 25-35 feet and requires a good ground for the mounting bracket at the top. This is a very popular antenna since the low bands have very good propagation right now, and is $39.95 ppd.

Daiwa 2-Meter Amplifier

The Daiwa LA2035 2-meter amplifier (.5/3 in, 30 out) has the same quality as their cross-needle meters. Operates FM/SSB/CW on 13.8 V dc. Comes supplied with mounting bracket, BNC connector installed on the front; the meter measures relative power output. Comes with power cord and built-in fuse; $65.00 ppd.

TE SYSTEMS

TE Systems has announced the availability of its new high-power UHF linear rf amplifier model 4410G which incorporates a high-quality GaAsFET preamplifier within the rf PA unit. The unit operates over the 420-450-MHz band and is particularly useful for OSCAR work. The rf power amp delivers 100 Watts minimum output power for 10 Watts drive and is compatible with all transmission modes (FM, CW, SSB, ATV). T/R switching sensitivity is rated down to ½ Watt. The front panel allows the operator to select the various operating options: PA on but no preamp, preamp on with PA off, etc. A 30-page manual accompanies the unit, describing it in detail. For more

TE Systems' 4410G power amp.

information, contact *TE Systems, PO Box 25845, Los Angeles CA; (213)-478-0591.*

UNADILLA/REYCO

W2DU HF and VHF High-Power Maxi-Baluns

The W2DU Maxi-Baluns (maximum power) contain no ferrite cores or material in the high-power portion of the circuit: no core to saturate at high antenna swr levels and therefore no harmonic generation. The internal feedline passes through a series of ferrite beads which prevent current flow on the outer braid. This prevents accidental radiation of rf interference and results in balanced currents on the two halves of the dipole. Since no coupling transformer is involved, error-free antenna impedance measurements can be made at the coaxial connector. The W2DU-HF and W2DU-VHF cost $19.95 each.

W2AU/W2VS 40- and 80-Meter Antenna Kit

Kit includes:

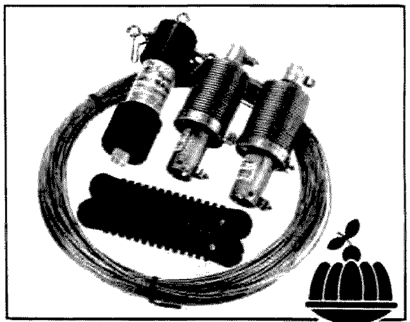
- 1 pair model KW-40 traps
- 1 W2AU 1:1 balun
- 1 pair W2AU end-sulators
- 125' quality #14-7 strand copper wire

When installed and adjusted per instructions, low swr results on 40 and 80 meters. Through a "multiple half-wavelength effect" (see chapter 21 *ARRL Handbook*) you also get resonance on 10, 15, and 20 meters. (Swr on 10, 15, and 20 will be higher, 2:1 to 4:1 typically, and a transmatch may be necessary to operate on these bands.) The kit costs $65.00.

W2VS Reyco Antenna Traps

- User tunable
- Special frequencies available
- Precision frequency paired
- Have 500-pound-plus pull-apart strength
- Weatherized

At resonance, the trap is an "open circuit" and cuts the dipole to resonant length for that frequency. Addition of traps to a dipole provides low swr on 2 to 6 bands, depending on how many are added. If a KW-40 pair is added there will be perfect dipole performance on 40 and 80 meters. Add five pairs, for example, and work 10, 15, 20, 40, 80, and 160 with low swr on each band. Over 200 different combinations are available, so exact operating performance may be selected. Each trap costs $18.00.



W2AU/W2VS antenna kit.

For more information, contact *Unadilla/Reyco/Inline, 6743 Kinne St., East Syracuse NY 13057; (800)-448-1666, NY/HI/AK/Canada (collect), (315)-437-3953.*

FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

THE WONDERFUL WORLD OF WIRE (AND CABLE)

I'm baffled. Not an unusual situation for Mr. "Fun!", I admit. But I just can't understand why our British cousins refer to the focus of our hobby as a "wireless." There must be more wires and cables in my shack than at the local phone company's switching center.

I'm not exactly renowned for my neatly dressed wires and cables. In fact, more than one person has twisted an ankle in my shack due to an encounter with the mess of wires on my radio room's floor. It raises occasional problems with my insurance company, of course, but I'm too lazy to do anything about it.

Which brings us to the topic of this month's "Fun!" column—wire. All of us live with wires every day, unless one has a severe mental problem, I suppose. Still, leave it to "Fun!" to bring a burning issue like wire into your shack and to your immediate attention. So put down that smoldering soldering iron, say 73 to that rare one on 20, and kiss the children good-bye. Sit down and read all about the wonderful world of wire.

Like I said, I'm baffled.

ELEMENT 1 MULTIPLE CHOICE

1) Approximately how much resistance (in Ohms) is there per 1,000 feet of 10-gauge copper wire?
  1) 1
  2) 10
  3) 100
  4) 1,000

2) What is the approximate loss of 50-Ohm RG-58/U in dB per 100 feet at 144 MHz?
  1) 1
  2) 4
  3) 6
  4) 8

3) Those old wire audio recorders used:
  1) steel wire
  2) copper wire
  3) aluminum wire
  4) iron wire

4) Which of the following substances can be a cable dielectric:
  1) a solid
  2) a liquid
  3) a gas
  4) all of the above

5) Faraday's famous ice-pail experiment:
  1) proved that conductivity is unaffected by ambient temperatures
  2) proved that charges reside only on the outside of conductors
  3) proved that wire can be drawn more accurately in a cold environment
  4) helped the ol' physicist make delicious ice cream

ELEMENT 2 TRUE-FALSE

	True	False
1) A composite cable contains one conductor made from multiple materials.	_____	_____
2) A composite conductor contains strands of different metals.	_____	_____
3) In the old days, hams used to wire high-voltage sections with nichrome wire.	_____	_____
4) A zepp is a type of wire antenna.	_____	_____
5) Dielectric dispersion is the variation of the dielectric constant with frequency.	_____	_____
6) Wiresonde is a system for transmitting meteorological signals through a cable within an airplane.	_____	_____
7) The "whisker" in an old cat's-whisker detector was a fine wire electrode.	_____	_____
8) Cable Morse code was used primarily in undersea telegraph applications.	_____	_____
9) The old "cactus needle" phonograph styluses were made from actual cactus needles.	_____	_____
10) The terms "cable loss" and "cable attenuation" are synonymous.	_____	_____

ELEMENT 3 MATCHING

Match the metal type in Column A with the correct relative conductivity at 68 degrees F in Column B (Copper = 100).

Column A	Column B
1) Aluminum	A) 65
2) Brass	B) 33
3) Gold	C) 15
4) Lead	D) 106
5) Nichrome	E) 28
6) Nickel	F) 55
7) Chromium	G) 16
8) Silver	H) 2
9) Tin	I) 13
10) Molybdenum	J) 59
	K) 7

ELEMENT 4 FILL IN THE BLANK

1) Another term for "dielectric constant" is _____
2) A wire cloth is usually an _____ _____.
3) The careful arrangement of wires in a chassis is called _____ the wires.
4) Unavoidable resistance in the wires within a circuit and in other hardware is often called _____ _____.
5) A wire duct is also a _____.

THE ANSWERS

Element 1:
1—1, 2—3, 3—4, 4—4, 5—2.

Element 2:

1—False	It contains multiple conductors.
2—True	In parallel, of course.
3—False	Not unless they wanted their projects to explode in their faces.
4—True	A horizontal half-wave wire antenna, to be more precise.
5—True	Important to remember on VHF and up.
6—False	From a captive balloon to the earth.
7—True	Pressed against a crystal.
8—True	It was a three-element system in which dits and dahs of equal length were represented by positive and negative pulses.
9—True	A far cry from the laser pickup in modern compact disk systems.
10—True	You bet. They both stand for a reduction of signal.

Element 3:
1—J, 2—E, 3—A, 4—K, 5—H, 6—C, 7—F, 8—D, 9—I, 10—B.

Element 4:
1—permittivity
2—electrical shield
3—dressing
4—wiring resistance
5—conduit

SCORING

Element 1:
Five points for each correct answer.
Element 2:
Two and one-half points for each correct answer.
Element 3:
Two and one-half points for each correct answer.
Element 4:
Five points for each correct answer.

How did you do?

1-20 points—You use wire cutters as nail scissors
21-40 points—You think that a wire is the same as a telegram
41-60 points—You know there are wires in your shack, but you're not quite sure what they do
61-80 points—You think that point-to-point wiring is a gas
81-100 points—You love wire so much, you save little snippets of it for future projects

SATELLITES

USING THE AO-10 APOGEE PREDICTIONS

Apogee predictions for the month of November are provided for three sections of the United States: Washington DC at 39N 77W, Kansas at 39N 95W, and California at 38N 122W. Times are in UTC and apogee in this case is mean anomaly 128 rounded to the nearest whole hour. Use the chart as a guide in aiming your antenna, then fine-tune the azimuth and elevation values to peak the satellite's beacon signal. If you require more accurate orbital predictions, contact AMSAT at PO Box 27, Washington DC 20044.

AMSAT-OSCAR 10 APOGEE PREDICTIONS
NOVEMBER 1985

			WASH		KANSAS		CALIF	
ORBIT	DAY	TIME	AZ	EL	AZ	EL	AZ	EL
2124	1	0600			229	4	207	18
2126	2	0500	235	0	221	11	196	22
2128	3	0500	229	2	215	12	189	21
2130	4	0400	221	9	205	17	177	23
2132	5	0400	215	11	199	17	171	20
2134	6	0300	206	16	188	20	160	19
2136	7	0200	195	20	176	21	149	16
2138	8	0200	189	19	170	19	144	11
2140	9	0100	177	20	159	17	135	6
2142	10	0000	166	20	148	14	127	0
2144	10	2300	155	17	139	9		
2146	11	2300	150	13	135	5		
2148	12	2200	140	9				
2150	13	2200	136	4				
2152	14	2100	128	0				
2157	17	0700					228	4
2159	18	0600					220	10
2161	19	0600					214	12
2163	20	0500			227	3	204	17
2165	21	0400	233	0	219	10	194	20
2167	22	0400	227	2	213	11	187	20
2169	23	0300	219	8	203	16	176	21
2171	24	0200	210	14	193	19	164	20
2173	25	0200	204	15	186	18	159	17
2175	26	0100	193	18	175	19	148	13
2177	27	0000	182	20	164	18	139	8
2179	27	2300	171	20	153	16	130	3
2181	28	2300	165	17	148	12		
2183	29	2200	154	15	139	7		
2185	30	2200	149	11	135	2		

HAM HELP

I need a schematic and manual for my Type 310 Tektronix oscilloscope. I will gladly pay all costs.

Vernon R. Davy
7915 West 91st Terrace
Overland Park KS 66212

I would like to modify a Fire Bird model F-50BM CB amp for 6 meters and need a manual or schematic.

Mike Hopkins AB5L
223 East 6th
Dallas TX 75203

ABOVE AND BEYOND

Peter H. Putman KT2B
84 Burnham Road
Morris Plains NJ 07950

This month I'd like to devote some time to a topic of vital interest to all hams, the current status and uncertain future of the 220-MHz (1.25-meter) band. Before I go any further, I'd like to add that two previous versions of this month's column were typed up and discarded—that's how fast the news has been coming in!

By now, most readers of the various amateur magazines have read about the numerous Petitions For Rulemaking (PRMs) and Notices of Proposed Rulemaking (NPRMs) that threaten to take the band away or share parts of it with other technologies. Two petitions are currently on file with the FCC to reallocate the bottom three MHz for land-mobile use (RM-4829 and RM-4831). An additional petition (RM-4983) seeks to use 350 kHz of the middle of the band on a shared basis with amateurs for a commercial data channel. The originator of this petition, Robert Snyder W9GT, does not operate 220 MHz and based his proposal on the apparent lack of 220-MHz activity he perceived from reading ham magazines and repeater directories.

The initial proposal met with a lot of objections from amateurs across the country, especially those in the congested New York City and Los Angeles areas, where 220 FM activity is high. Subsequent release of technical information by a manufacturer of geophysical location transmitters (Fairchild) revealed that their system required a bandwidth of 2.4 MHz, and to top it off there has been an upsurge in the purchase of new 220-MHz gear in the past six months. Snyder filed additional comments on his own proposal to the effect that adjacent unused TV channels might be better used in his scheme, in accordance with a similar proposal made by the ARRL. Failing that, he added, the amateur population might not object after all to sharing at least the 350-kHz service in the center of the band as opposed to losing outright 2 to 3 MHz, if not the entire band.

Whew! Heavy stuff, indeed. What makes 220 MHz so desirable, and why aren't more amateurs using the band? There are many possible answers. Let's start with a brief overview of this frequency segment and its characteristics. 220 MHz has long suffered as the "odd man out" among VHF and UHF bands because it isn't related harmonically to other popular VHF bands (as 432 MHz and 1296 MHz are). Commercial 220 equipment is scarce, and the fact that 220 is strictly a North American amateur allocation cuts into the potential market for the major manufacturers. Amateurs are a determined lot, however, and many have "rolled their own" equipment and antennas.

Propagation is very similar to 144 MHz—so much so that many hams in the know are switching their repeater operations up from 2 meters to take advantage of the quieter, less congested channels. Antennas are physically smaller (a quarter wave on 144 MHz is 19 inches; on 220 it's just 12 inches). Not only that, the TVI headaches that are increasingly plaguing amateurs in areas with cable TV are nonexistent on 220 because the highest VHF channel (Channel 13) lies just below the band edge at 216 MHz. Indeed, users of 220 near major metropolitan areas with a Channel 13 can have their hands full with front-end overload in their receivers.

Enhanced propagation occurs mostly in the troposphere, although sporadic E is certainly possible and many contacts have been made via meteor scatter. Moonbounce fans love this band, as it is relatively quiet. And with a full 5 MHz of bandwidth, there's plenty of room to accommodate all interests, from FM to weak-signal work to EME. Additionally, 220 is the lowest frequency band on which remote linking is allowed by the FCC. And although technically it is "co-shared" with the government, there is virtually no interference from other services.

So why isn't everyone rushing to get on the bandwagon (pardon the pun)? It could be the lack of equipment. Although there are those who would say that a real ham builds when nothing is available, the reality today is that most people would rather spend the money and buy it ready to go. I certainly couldn't build an IC-37A for three hundred dollars if I had to! Several manufacturers do make excellent FM transceivers for 220, among them ICOM (the aforementioned IC-37A and the IC-3AT), Santec, and Azden. Kenwood's new TH-31 is a big hit due to its small size. And of course, there are the venerable Midland 13-509 and 13-513 transceivers of a few years back when it looked like a no-code 220 license was going to become a reality. Yaesu did manufacture a 220 radio several years back and has come out with a new model (FT-103). Yaesu is actively soliciting comments regarding a 220 module for their extremely popular FT-726R multimode transceiver.

All fine and dandy, except these radios, with the exception of the possible 726R module, are all FM only. What about SSB? CW? Even AM? Here's where things get a bit sticky: There are no 220-MHz multimode radios on the market as of this date, although ICOM solicited comments from visitors to their booth at Dayton regarding the viability and suitability of a 220 multimode. They've just announced a multimode for 1296 MHz (IC-1271), and although the 1296 (23-cm) band is a worldwide allocation, I can't help but wonder if the market is as big as that for a 220-MHz multimode.

The other option would be to build or purchase a 220-MHz transverter to use with an appropriate low-band radio. There are a few sources for these units, such as Hamtronics in Rochester, New York, and Transverters Unlimited of Toronto, Ontario, whom we'll get back to in a moment. There have also been rumors that SSB Electronics of Germany is considering a 220-MHz transverter for the US and Canadian market. Such transverters typically put out 2 to 15 Watts and can be used with many of the popular solid-state amplifiers, such as Mirage. One advantage of using a transverter is the low initial cost to get on the band, provided you already have a low-band transceiver with the appropriate connections. Or you can use a 50-MHz multimode to drive the transverter if you wish.

Hmmm. We still haven't come up with the answer. There's certainly enough equipment to get started, although not anywhere near the selection available on other bands. And the band seems relatively free of congestion. Antennas certainly aren't a problem, as KLM, Cushcraft, Larsen, and others all make a variety of 220 models. So what is the reason that more people aren't on 220?

Ready? The answer is . . . I don't know. Neither does the ARRL, the FCC, nor any of those Japanese manufacturers. If 220 MHz was a Japanese allocation it would be jammed full of amateurs by now. We'd have our pick of multimodes, handie-talkies, repeaters, peripheral equipment such as computer interfaces, antennas, amplifiers, you name it. It's hard to conceive that a band such as 220 situated where it is with its propagation characteristics and bandwidth of 5 MHz lies mostly dormant with the exception of FM activity in the major population areas. And this is precisely why there are so many who desire to take away some or all of the band for commercial uses—because it just isn't being used.

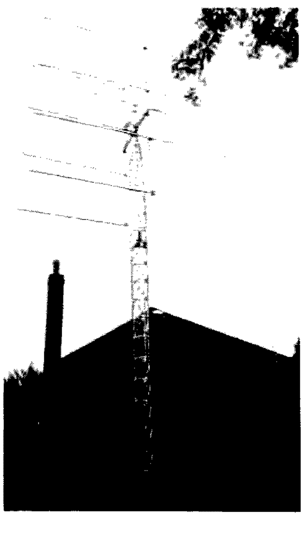
Now for the bombshell. As you have heard by now, the ARRL has proposed (RM-5038) to allow Novices voice privileges on 28 MHz, 220 MHz, and 1200 MHz. Stating that many Novices drop out after obtaining their licenses, and that if amateur radio is to grow and prosper in the future it will be through the Novice ranks, the ARRL makes a convincing case for the proposal. Consider this: With the sunspot cycle at the absolute bottom, propagation on two of the Novice bands is terrible (15 meters and 10 meters). Add the QRM on 40 meters from foreign broadcast operations and QRM from Canadian phone operations on 80 meters. What's a Novice to do? With many Novices living in apartments, condominiums, and dwellings where antennas are severely restricted, it certainly adds up to a high dropout rate.

Not only that, but using CW exclusively deprives the aspiring amateur the chance to improve his or her phone techniques! A voice allocation on 220 MHz would do exactly that. Under the terms of the proposal, Novices would be limited to 25 Watts on 220 but could use repeaters (although not be a trustee of one). Art Reiss K9XI makes an excellent point in his *220 Notes* for August, 1985, and that is that with the emphasis away from public service on CW and towards the VHF handheld radio, allowing Novices to use 220 FM provides a large cadre of operators whose talents and willingness to help would otherwise go to waste.

For those with an interest in computers, 220 is fast becoming a hotbed for packet-radio activity. Many new Novices share this interest in computers, and a 220 digital privilege could be just what the doctor ordered. The point to be gleaned from all of this is that giving Novices these privileges means more activity on 220 and more active hams in general. And more activity on 220 means we can stop worrying about losing this allocation and get on to more important matters that face amateurs today. The ARRL proposal is one of the best things—indeed, the best thing—I've seen come out of Newington in a long time. It deserves your support.

What's a good way to get active on 220 with a minimum of cash outlay? If you are into repeaters, then a hand-held might be your best choice. But here's a better idea: If you already own one of the newer all-mode low-band transceivers (ICOM 751, 745, Kenwood 430, 930, Yaesu FT-757GX), then the answer might be a transverter. This ingenious device mixes low-level rf from your HF transceiver wtih an on-board local oscillator to produce coverage of the desired band segments on 220. Best of all, you retain the modes of operation on your

Hans VE3CRU fixing a sick 1296 Microwave Module.



The EME array at VE3CRU. On 432, Hans uses 1.5 kW into eight 32-element yagis and has worked Australia, Japan, and Germany.

HF transceiver because the transverter is *linear*. That means you can work 220 SSB, CW, AM, and even 220 FM.

Where do you get one of these magical boxes? One source is Hans Peters VE3CRU of Transverters Unlimited in Toronto, Ontario, who has been custom building his own 220-MHz versions of the popular Microwave Modules for some time now. The factory in England doesn't make a 220-MHz model, so Hans uses identical parts and cases made in the US and Canada to make his modules. He started this enterprise back in the late 70s after tearing his hair trying to locate a 220 transverter, and the results have been surprising.

The basic "Canadian" Microwave Module comes with a choice of two i-f frequencies: 28 MHz and 50 MHz. Hans recommends the latter due to improved spurious rejection. He works out of his house in what can best be described as a "well-equipped basement," complete with a machine shop and all sorts of test gear. Hans normally orders parts for about 50 to 100 transverters at a clip and spends a good deal of his free weekend time building them up. The newest versions develop typically between 15 to 20 Watts of output and use high-performance MOSFETs in the front end. Add a 13.8-volt source and an antenna, and you're on the air for about $220, which is very reasonable.

Note that with conventional radios using 28-MHz i-f's, coverage of any 2 MHz of the band is possible. But by adding a second crystal in the local oscillator and a front-panel switch—similar to the 432 "S" transverter with OSCAR coverage—you can select a different band segment. By using such a switch with a continuous-coverage HF transceiver, the 27-30-MHz segment translates to 220-223, 221-224, or 222-225 MHz. By employing the FM mode on the HF transceiver, you can now work repeaters and FM simplex. Pretty neat, eh?

By using a 50-MHz i-f, coverage of any 4 MHz is possible. Most 50-MHz multimodes have an FM option installed or available. And it will give you something to do when six meters is quiet. Hans pretty much lets the buyer decide the i-f and will install the dual selectable crystals if desired for a small additional price. He does not advise using a 144-MHz i-f due to the inability to produce a "clean" signal with spurious emissions suppressed sufficiently. One additional feature on the 220-MHz modules is the ability to select separate transmit and receive connections at the desired i-f frequency, so you could use a separate transmitter and receiver, if desired. Or, if you wish to operate transceive at the i-f frequency (as the ICOM 751 and 745 do), a single connection can be made to the module.

Hans also carries other products of interest to the VHF/UHF enthusiast, among them a brand-new water-cooled 1296-MHz 250-Watt amplifier for around $250. Being an avid moonbounce operator and chaser of grid squares on 432 MHz, Hans is no stranger to the ins and outs of the higher bands. When I visited him recently, I brought along three Microwave Modules for a "tune-up"—1296, 144, and 220—and was I surprised to watch him strip down and rebuild the 220 module in about 40 minutes! Apparently the unit I had bought used was an older model and many production mods had been made in the intervening years. Hans wound all of the new coils from memory, which shows you how many times he's been inside one of these black boxes. Sure enough, the new unit exceeded specifications, developing 30 dB of gain at the i-f port and making 13 Watts across a 50-Ohm load.

Hans is also a member of the active contest group VE3ONT, which many of you may recognize from the June and September contests. He's busy chasing VUCC on 432 MHz with his moonbounce setup (despite a minor setback when his tower fell on his neighbor's house) and uses an 8938 tube at 1500 Watts to eight 32-foot homebrew yagis to work EME. Look for him on 432 in the upcoming contest season, and if you want to know more about the 220 transverters, 1296 amplifiers, or other products he carries, write to him at: Transverters Unlimited, PO Box 6286, Station A, Toronto, Ontario M5W 1P3.

Want to run more power on 220? There are many ways to do it and several manufacturers of 220-MHz solid-state amplifiers. But perhaps the best deal to come out in a long time can be found at Fair Radio Sales in Ohio. Their 1985 catalog features the AM-6155/GRT-22 UHF power amplifier with power supply for just $159.50. This unit was originally made for the FAA and uses an 8930 tetrode (available from Eimac, and one is included), but as it comes it develops 50 Watts out for 10 Watts of drive. Obviously it has been set up for derated service! With a few simple modifications, this same unit will produce between 300 and 400 Watts of output with a drive level of just 4 Watts. The power supply is sturdy enough for this power level, although increased drive just pulls the plate voltage down.

The modifications are not difficult and it will take a modest amount of time to make the stock unit into a reliable workhorse amplifier. One bonus is that the AM-6155 unit utilized a tunable cavity to cover the intended frequency range, but by changing the position of the plunger in the cavity, operation can be had on 144 MHz as well. I'll cover these modifications in more detail in the next column. Make sure that if you want 220-MHz and/or 144-MHz operation, you purchase the AM-6155 and *not* the AM-6154, which will cover 144 MHz only (and costs more to boot). The source for these surplus units is: Fair Radio Sales, PO Box 1105, Lima OH 45802.

This month we hear from the Southern California Six Meter Club about a sensational two-meter opening between Hawaii and San Diego. (Seems like a logical place to hear about two meters!) Bob Hastings K6PHE and his wife Gracie N6FSL both received 5 × 5 reports from KH6IAA and KH6HME. For those of you who just dropped your HTs on the floor in shock, I might add that this path has also been worked on 220, 432, and recently on 1296 MHz! The cause is tropospheric propagation in the form of an enormous duct to cover the 2500+ miles. A similar duct has been observed between Bermuda and many stations on the East Coast on 144 MHz and 432 MHz. SCSMC is an active group that publishes a very nice looking newsletter which is professionally typeset and features articles about six-meter repeaters that can be worked via sporadic E in Washington, as well as a schematic for a 6- and 2-meter duplexer for mobile use. Look for them on 6-meter SSB when the band opens, and I'll look for you next month "Above and Beyond."

Additional note: An excellent source of information about the 220 band and the fuss in Washington is the *220 Notes*, published by Art Reiss K9XI. A one-year subscription costs just five dollars for six issues. For more information, write: Walt Altus WD9GCR, 215 Villa Road, Streamwood IL 60103.

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

OK, Apple owners, this month is your turn! We are going to take a look at some of the material you have sent in on the various RTTY programs for the Apple. If I can draw one theme from it all, you all seem disappointed.

Although the Apple II and various offspring have at times been felt to be some of the most popular home computers ever made, viable RTTY software for the Apple, at this point in time, seems to be scarce, according to information received here.

First on the list is a program which several hams call the "Galfo" program. I have no other information than that, not full name, nor source, nor price. I even don't know if it is still available. One ham calls it "fair," another tried it and switched to one of the other programs described later. If any of you readers can supply specifics, I would be glad to report on it.

Next comes a program called Super-RATT. Quite a bit was written about this program some years ago, and it appears that quite a few of you are using it. Unfortunately, the publisher can no longer be found. Another one for the shelves, I guess.

You know where that leads us? Back to Kantronics, the source of some of last month's software, to look at two of their products, Hamsoft and Hamtext. Hamsoft, Kantronics' basic RTTY program, includes a split-screen display using the standard Apple screen, a type-ahead buffer, and message ports. However, some of you do offer rather pungent comments about this program. One ham related that he thinks the "...software is sadly deficient. It makes no use of my 80-column card, no upper- and lowercase in ASCII. It makes no use of the disk drive. Storage of incoming RTTY would make me very happy. I would prefer to store RTTY art, computer programs, weather, news, and other information gathered from the radio onto disk. This would give me the ability to edit out useless info on a word processor before printing. I really hate to retype programs. I would love to come home from work and read a disk's contents. I have tried just leaving the printer on all day and returned to find a 200-sheet stack of paper eaten up by a civil-defense network. I imagine that hams would be disappointed with this software—especially if they didn't own a printer."

The next step up is to Kantronics' Hamtext program. This program allows tape and disk transfer, printer outputs, and more. More? Well, one of you detailed what happened when you went looking for a better RTTY-trap. "Imagine my surprise when I opened the package and found not only the expected disk, cable, and manual, but also a printed circuit board that had to be put into one of the expansion/interface slots in my Apple IIe. Nary a word in the advertising material alluded to that method of interfacing. I really suspected it to be a method of copy protection. But to my pleasant surprise there was also a simple clock on the Hamtext interface board. Lack of a clock in the Apple had been a very sore subject with me, as all my friends with cheap Commodore machines had clocks in all their simpler programs. There is also a printer connector on the board which I have never found any reason for."

"My original Hamtext did not include AMTOR. I found that Kantronics was willing to add AMTOR to the disk for a reasonable sum so I sent it in to have it added. When it arrived, it would not boot the menu and the 80-column mode wasn't just right, so back it went. To their credit they sent me a loaner program while they worked on the bugs in mine. Later I got mine back and returned their loaner disk."

"The Hamtext program will not allow relaying incoming data, but data has to be saved and called up from a disk file for transmitting. Message ports cannot be loaded without leaving the T-R mode, so you cannot put in the call, etc., of the station you are working. I work other guys who have those features. It's enough to drive one to a dedicated RTTY terminal unit of some sort."

One of you loves to operate his Apple on VHF, and only VHF, RTTY. "My enthusiasm with RTTY on VHF is a product of the fact that my Apple puts up an incredible amount of interference with the HF radio. I have tried everything to cut down emi and have resorted to tuning up a signal on the interface and taping it for later perusal. This also keeps me from printing up reams of unusable stuff (*that's one solution—MIL*). I have grounded everything, wrapped all of the cables in aluminum foil, and grounded that. I am considering mounting the Apple in a shielded box with an external keyboard and I/O ports in the open."

I hear you, and I hope the manufacturers do, too. My thanks to Dave Brown W9CGI, Ben Irvine N3CNH, Paul Mellinger NI6P, William Schmit, and all the others who volunteered information about the Apple on RTTY.

On a related front, several of you have dropped me notes regarding some of the schematic diagrams printed here which have been drawn by computer. Well, I have been playing with a new tool for this which makes the job even easier. Using the superior graphics capabilities of the TRS-80 Color Computer®, the Schematic Drafting Processor by Tony DiStefano (and marketed by Spectrum Projects) does for drawing schematics what a word processor does for writing articles.

Features of this program include the ability to place any of thirty predefined schematic symbols anywhere on a worksheet which measures 480 by 540 pixels in size. Logic gates, integrated-circuit chips, resistors, and more are all preloaded into the system and can be placed with the movement of a joystick cursor and a few keystrokes. Special symbols can be defined and loaded in for specific applications.

There are routines in this program to dump the full worksheet to a printer, as well as to save it to disk. The only problem I can see is that the SDP is set up to use the standard CoCo "bit-banger" printer port. Many of us are using other interfacing techniques, including parallel PIA ports. The SDP will not address these. Nonetheless, at under thirty dollars, this is a superb addition to the library of an electronic enthusiast.

Another sleeper discovery for the CoCo, by the way, goes under the mysterious code number of 277-1019. You will find it in your local Radio Shack, no doubt, called a "Computer Keyboard QWERTY format—57 keys." What you may not realize is that this was the keyboard for the Super-CoCo that was never made. Sporting an ALT, Control, and two Function keys that current CoCo software does not support, this keyboard drops into the newer CoCo boards. With some creative software, and if (I don't know) the programs used for the other keyboards with Function keys will work, this makes quite a nice upgrade. The price? How does $4.95 grab you? That's not a misprint—under *five bucks!* Check it out.

Don't forget the Postal Service and CompuServe connections for getting in touch with me. Send letters to the above address, with a self-addressed, stamped envelope for replies. CompuServe EasyPlex can be addressed to ppn 75036,2501. Either way, I'll try to answer as soon as I can. And again, if you want a current reprint list, just drop me a note, with an SASE, and I'll send the list by return mail.

Here is the list of companies mentioned today, that I know you can get ahold of. If the publishers of the programs mentioned above and not listed below wish to send me current information, I will be delighted to print it when received: Hamsoft and Hamtext, *Kantronics, 1202 E. 23rd Street, Lawrence KS 66046*; Schematic Drafting Processor, *Spectrum Projects, PO Box 21272, 93-15 86th Drive, Woodhaven NY 11421*.

Once again, when you contact these folks about their RTTY equipment, please tell them that it was in *73*'s "RTTY Loop" that you saw it mentioned, OK? You understand, it's not for me, but to allow the manufacturers to know where the amateur community gets its information, so that they might tailor their direction for their next product line. And, of course, where else to read about that new and exciting piece of RTTY gear? Right here, in "RTTY Loop."

LETTERS

SEGREGATE NOVICES

I am very interested in the proposition of a Novice phone allocation on the higher frequencies to encourage would-be amateurs. Look at what vfo operation and the raising of the 75-Watt limit did for the Service.

I think that with today's state-of-the-art radios it would be a fine thing to allocate some phone privileges to them, like a carrot on a stick. However, I do *not* go along with letting any of the higher-class licensees indulge in their allocation. Keep it strictly for Novice operation. This would let them keep all of their contacts on a Novice plane, to exchange information. Outside of this, I think it would be a grand opening for beginners.

Jack Golden KK2W
Portville NY

Great idea, Jack. And while we're at it, let's make the General subbands General-only. Likewise the Extra and Advanced portions. That way, you and I can keep our contacts on an Extra plane, and we won't be bothered by those rotten lower classes, right? How are the Novices going to learn proper techniques unless we teach them? And how can we teach them if we can't contact them? Call them on the phone?—KW1O.

DROP NOVICE TICKET

With regard to the proposed expansion of Novice privileges, I fail to see the real benefit in offering something extra to someone who has no idea of what ham radio is and, therefore, no interest in the hobby. An increase in our ranks is not going to come from either fewer restrictions or more privileges. Go ahead and offer anything you want to the man on the street, and then ask him if this would entice him to become a ham. You're going to get one of three answers: "Yes," "No," or, "What's ham radio?" If we haven't yet explained what the refrigerator is, who will care that it comes with an automatic ice maker? And once you've explained things, how do you convince him that he wants it?

The young kids of today are involved with computers—they've been getting beat over the head with them since the advent of the pocket calculator. "Computer Literacy" has even become a required course in some schools. I haven't seen any ham-equipment manufacturers following IBM and Apple's lead and donating or discounting gear. The competition with other hobbies is fierce, but we are not even advertising—and we have a 400,000-person sales team!

As for the proposal itself, I'm beginning to feel like I've been had. We've argued no-code until we can't stand it anymore and now this compromise comes along hot on its heels. Are we still smarting enough from the no-code fiasco to agree on any proposal that comes up? Is somebody pulling a New Coke/Classic Coke marketing ploy on us?

If you want to make the first ham ticket more inviting by broadening the privileges, why reinvent the wheel? Just dump the Novice ticket and make the first license the Technician class. With that you've given the newcomer all of the privileges from 6 meters on up plus CW on the HF bands. The combined Novice/Technician test would be one that's worth its salt, there would be only a minimal change in regulations, we wouldn't have even more confusing subbands, and there's still an incentive to upgrade.

Since it is the only alternative at the moment, I'll support the proposal as written, but I can't help feeling that we aren't seeing the forest for the trees. The problem is not that the Novice license doesn't offer enough, it's that the non-ham doesn't know what ham radio is. Actions speak louder than words, folks. Forget the many pages of legalese and do a little PR work at the grass-roots level.

William Itter N9EWA
Schaumburg IL

ADD EXAMINATIONS

I have just finished reading the August, 1985, issue, and the letter from WA2VPH on state-of-the-art equipment got me thinking. He is absolutely correct in saying that practically no one can repair their equipment anymore. The sophistication of

the integrated circuit has ensured that. As a result, probably 80% of active amateurs are simply operators. Even the license tests are really a matter of memory, guesswork, and luck. Little, if anything, is determined by them about one's ability to demonstrate a practical application of electronic knowledge.

Maybe we need a part of the test to actually require such a demonstration. This could be in the form of troubleshooting, construction, or perhaps simple measurements and deductions obtained by using various pieces of standard test equipment on working circuits. Different classes of license would require differing degrees of difficulty. For example, a General-class test might require that, given a typical oscillator circuit, one would need to connect it to a power supply, fire it up, and determine such things as the operating frequency, power in and out, waveform, etc. With the volunteer examiner program now in place, the additional cost of providing the equipment needed for this type of test is zero. Enough of this stuff is sitting in garages right now to run the program forever.

I would also point out that the remarks made by FCC Commissioner Kowalski ("QRX," August, 1985) support this suggestion. If, by licensing amateurs in this manner, it could be demonstrated that a national capability is being increased by providing a group of citizens who have shown some technical skills, this demonstration alone would separate hams from other users of the spectrum. A skilled ham contributing to and increasing our national human resource is much more difficult for Congress to eliminate than a bunch of hobbyists.

Everyone is looking for a way to upgrade and expand the participation in the Amateur Service. If the license actually had some value indicating that the holder possessed some skill or proficiency (other than the ability to send and receive Morse code), maybe those talented youngsters who have deserted us would return.

D. S. Jenkins WA6OGH
Tarzana CA

NEW PRODUCTS

NONCONTACT VOLTAGE DETECTOR

A hand-held instrument that emits an audible ticking sound in the presence of ac voltage is available form Louis and Beech. The Tic-Tracer can be used to safely check for live wires without touching them, to find hidden wiring, and to check fuses and breakers. The Tic-Tracer can also detect which side of a two-wire cord is hot.

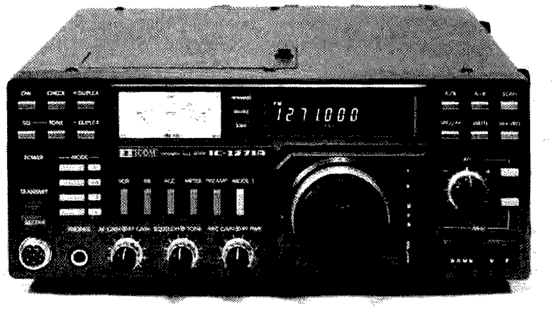
The Tic-Tracer is housed in an 8-1/2" × 2-3/4" × 1" case and operates on two AA batteries.

For complete information, contact *Louis and Beech, PO Box 19580, Detroit MI 48219.*

ICOM IC-1271A

ICOM has announced the IC-1271A 1.2-GHz transciever. The unit covers 1240 to 1300 MHz with 10 watts of output. Features include 32 memory channels, scanning, multimode operation (including ATV), and a GaAsFET front end. Options available are the TV-1200 ATV interface unit, the IC-EX310 voice synthesizer, the UT-15S CTCSS encoder/decoder, and the IC-PS25 13.8-V-dc internal power supply.

For more information, contact *ICOM America, Inc., 2380 116th Avenue NE, Bellevue WA 98004.*

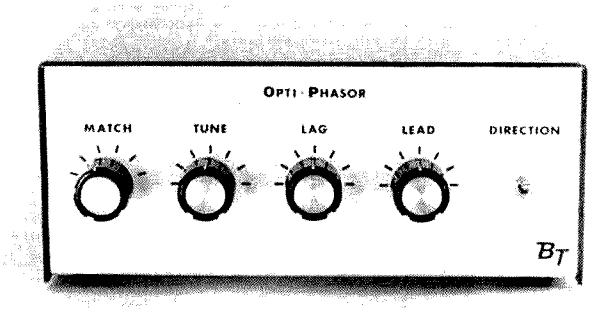


ICOM's IC-1271A 1.2-GHz transceiver.

BAILEYTECH OPTI-PHASOR

BaileyTech's new Opti-Phasor is an in-the-shack 40-meter phasing unit designed to drive a pair of dipoles or inverted vees as a phased array. Variable-reactance phasing allows the antenna currents in the two wires to be precisely balanced so that a deep null and optimum gain can be achieved. A front-to-back ratio of 20 dB is typical, and the null is steerable.

For more information, contact *Bailey-Tech, 304 West S. College Street, Yellow Springs OH 45387.*

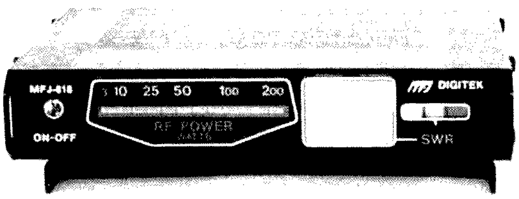


The BaileyTech Opti-Phasor.

MFJ DIGITAL SWR/WATTMETER

MFJ Enterprises has introduced the MFJ-818, an automatic digital swr/wattmeter. A 12-bar LED display shows up to 200 Watts of output power, and 1/2-inch LED digits indicate swr from 1:1 to 9.9:1. A three-color LED displays the impedance match between antenna and transmitter: green for good, yellow for marginal, and red for poor matching.

Complete information about the MFJ-818 is available from *MFJ Enterprises, PO Box 494, Mississippi State MS 39762.*



MFJ's 818 power/swr meter.

MIDLAND DESKTOP REPEATER

Midland LMR has introduced a four-channel desktop repeater for commercial two-way FM radio systems. The VHF high-band model covers 150-174 MHz with either 2-5 or 5-35 Watts of output, and the UHF model covers 450-470 MHz with either 2-5 or 5-25 Watts of output. Both models will accept an optional CTCSS module. The standard units require separate transmitting and receiving antennas, but an optional duplexer permits the use of a single antenna. Both models come with one set of crystals.

For complete information, contact *Midland LMR, Marketing Department, 1690 North Topping, Kansas City MO 64120.*

Midland LMR's desktop repeater.

REGENCY Z60 SCANNER

Regency Electronics has announced the Z60 scanner/clock radio. The Z60 receives up to sixty channels on eight bands. Fifty channels may be used to monitor VHF-Low (30-50 MHz), VHF-Aircraft (118-136 MHz), VHF-Amateur (144-148 MHz), UHF-Amateur (440-450 MHz), UHF (450-470 MHz), and UHF-T (470-512 MHz). The remaining ten channels are dedicated to the FM broadcast band (88-108 MHz).

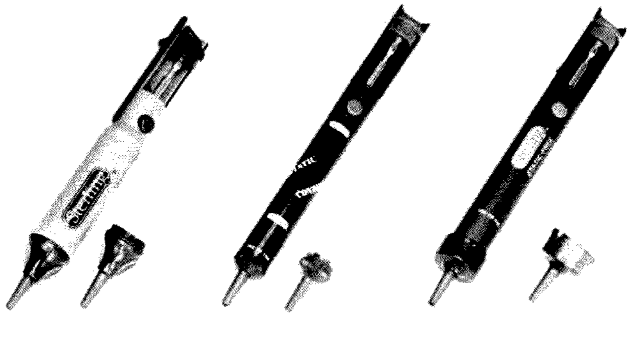
The Z60 requires no crystals and comes programmed with 60 popular frequencies. A search mode will scan an entire band for activity. Also included is a built-in alarm clock.

For complete details, contact *Regency Electronics, Inc., 7707 Records Street, Indianapolis IN 46226.*

WAHL DESOLDERING TOOLS

Wahl Clipper Industrial Products has introduced a new series of desoldering tools. Two styles feature static-free tips and one is an anti-static model. All feature high vacuum, recoil protection, and a self-cleaning plunger. All are balanced for one-hand operation and have comfortable thumb profiles.

For more information, contact *Wahl Clipper Corporation, Sterling IL 61091; (815)-625-6525.*



Wahl Clipper desoldering tools.

REVIEW

IC-735
HF TRANSCEIVER

If there's a rig on the market which proves that "good things come in small packages," it's the ICOM IC-735, the successor to the IC-730. At 9" × 9" × 4" and 15 pounds, this 100-Watt HF transceiver is loaded with just about any feature an operator could want. As you would expect, CW and SSB are standard, but so are AM and FM, and it is a general-coverage receiver as well.

Among its other features are dual vfo's, 12 memories, passband tuning, notch filtering, a built-in 10-dB preamplifier, and a green liquid-crystal display which indicates frequency, mode, vfo selection, and memory.

With as many features as it has, you would think that the IC-735 would be confusing to operate. After all, there are 44 switches and knobs on the front panel—you have to admit that that number is quite high. But, after using the rig for a few minutes, the controls quickly become second nature. In fact, the labeling is so clear that you are never left wondering what a switch will do. For example, you know that ATT cuts in the attenuator and PRE AMP activates the preamplifier.

In fact, during the time I used the IC-735, I had few problems with it at all. Most of my operating was casual—a CW contact here and a phone rag-chew there. In this type of service, I found the rig much more than adequate. I would suspect that the combination of notch and passband tuning, the 20-dB attenuator, and the 500-Hz CW filter will make this a good basis for a contest station.

There is one proviso to this, though: In the presence of strong signals the IC-735 tended to pump, as if there was too much agc. I don't think the agc was the problem because I had adjusted everything according to the instruction manual. What I think was happening was that the front end of the receiver was becoming overloaded in the presence of many strong signals, and this forced the rig to pump. Flipping on the attenuator, as well as the narrow CW filter, alleviated much of this problem.

All things considered, this is a fairly minor shortcoming in an otherwise excellent piece of equipment. In fact, you can easily work around it with the existing controls. It's just that you should be aware it's there up front, rather than suspecting something is wrong and crating the rig back to the factory, when, in fact, there is no problem.

Features

For most operators, though, the IC-735 should be more than enough transceiver. With its features and microprocessor control, there is very little the IC-735 can't do. For example, it is possible to select and program up to 12 frequencies in the rig's memories. You can then select and use a memory frequency for the basis of your operation or you can choose one of the two vfo's. The memories will not only hold the frequency you've selected, but also the mode you've chosen.

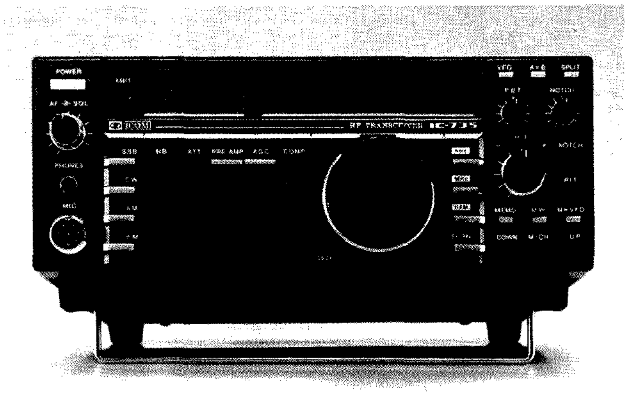
An interesting sidelight is the IC-735's automatic choice of the correct sideband operating position, USB above 10 MHz and LSB below. This is in agreement with international convention and it makes this rig more convenient to operate. However, if you run into a situation where you must change the sideband position—RTTY, for instance—you can easily do this by touching the SSB key and the mode will change.

One of the nicer features of the IC-735 I reviewed was its built-in electronic keyer (optional). Although you can't change the dot-dash weighting of the keyer—it's set for 3 to 1—most operators will be more than happy with the CW keyer capability of the rig.

The keyer's speed can be varied from about 10 to about 45 wpm, and while I suspect an ardent contester may want a keyer with more functionality, most casual operators should find the electronic keyer more than adequate.

One feature which I especially liked was the IC-735's full CW break-in. Simply pushing the BK IN switch (located behind a smoky plastic cover) allowed me to have full break-in, which was nice during several CW QSOs. It does take some playing with to become used to the slide adjustment for the keyer's speed, but once you've found a setting that you're comfortable with, you can set it and forget it.

Another particularly nice feature on this rig was the narrow (500-Hz) CW filter (another optional item). The CW filter enabled me to fine-tune any CW signal and eliminate just about all QRM, unless, of course, the QRM was right on top of the signal I was trying to copy. The notch and passband tuning features allowed me to vary



The ICOM IC-735.

SPECIFICATIONS

Semiconductors:	Transistors	124
	FETs	18
	Diodes	258
	ICs (including CPU)	42
Frequency coverage (MHz):	1.8-2.0 3.4-4.1 6.9-7.5 9.9-10.5 13.9-14.5 17.9-18.5 20.9-21.5 24.4-25.1 27.9-30.0	
General-coverage receiver:	0.1-30 MHz, receive only	
Operating temperature range:	−10° C to +60° C	
Frequency control:	CPU-based 10-Hz-step digital PLL synthesizer, independent transmit-receive frequency available on same band	
Frequency readout:	6-digit 100-Hz illuminated LCD	
Frequency stability:	Less than ±200 Hz from 1 minute to 60 minutes Less than ±30 Hz after 1 hour at 25° C Less than 500 Hz in the range of 0° to 50° C	
Current drain:	Transmitting at 200 Watts input, approximately 20 A Receiving at maximum audio output, 1.5 A; squelched, 1.2 A	
Antenna impedance:	50 Ohms unbalanced	
Weight:	5 kg	
Dimensions:	94 by 241 by 239 mm (about 4" by 9" by 9")	
Transmitter output:	SSB—200 Watts PEP CW—200 Watts input AM—40 Watts output FM—200 Watts input (power output is continuously adjustable from 10 W to 100 W)	
Emission modes:	A3J (J3E) SSB A1 (A3A) CW A3 (A3E) AM F3 (F3E) FM	

Harmonic output:	Better than 40 dB below peak power output
Spurious output:	Better than 50 dB below peak power output
Carrier suppression:	Better than 40 dB below peak power output
Unwanted sideband suppression:	More than 50 dB down at 1000-Hz af input
Microphone:	600-Ohm electret with push-to-talk and scanning buttons
Receiver	
Receiving system:	Triple-conversion superheterodyne with continuous bandwidth control
Receive modes:	A3J (J3E) SSB A1 (A3A) CW A3 (A3E) AM F3 (F3E) FM
Intermediate frequencies:	1st—SSB, AM, FM, 70.4515 MHz CW, 70.4506 MHz 2nd—SSB, AM, FM, 9.0115 MHz CW, 9.0106 MHz 3rd—SSB, AM, FM, CW, 455 kHz
Sensitivity (preamp on 1.6 to 30 MHz):	SSB, CW, 0.1-1.6 MHz, less than 1.0 uV for 10-dB S/N 1.6-30 MHz, less than 0.15 uV for 10-dB S/N AM (narrow filter), 0.1-1.6 MHz, less than 6 uV for 10-dB S/N 1.6-30 MHz, less than 1 uV for 10-dB S/N FM, 1.6-30 MHz, less than 0.5 uV for 12-dB Sinad
Squelch sensitivity:	FM, 0.3 uV
Selectivity:	SSB, CW, 2.3 kHz at −6 dB, 4.0 kHz at −60 dB AM, 6 kHz at −6 dB, 18 kHz at −50 dB FM, 15 kHz at −6 dB, 30 kHz at −60 dB
Spurious and image-response rejection:	More than 80 dB
Notch-filter attenuation:	More than 30 dB
Audio output:	More than 3 W at 10% distortion with 8-Ohm load
Audio impedance:	8 Ohms

the width of the passband to help null out QRN and QRM. When this filtering is combined with the CW filtering, I found it possible to eliminate any trace of interference to the signal I was listening to.

As I used the IC-735, I came to appreciate the work ICOM has done on it. For example, the shaping of the CW signal was the way I like it. The waveform was clean and its rise and decay times produced a clean signal. There was no chirping or ringing which would have indicated a waveform which was too soft or too sharp.

You must use a stereo phone plug to install a paddle so you can use the electronic keyer. You can also disable it by pushing the electronic-keyer on-off switch. When this is disabled, you can use either a straight key or an external keyer. The CW jack is in the rear.

Through all the testing and use I gave the IC-735 throughout the review period, I found the output to be a stable 100 Watts in all modes but AM. With the rig in the AM setting, power output was 40 Watts. ICOM rates this rig at 200 Watts input power, but a truer measure was my wattmeter, which showed a 100-Watt output. This means you can use the IC-735 to drive just about any amplifier to the legal limit. At the same time, the IC-735 can serve as a QRP rig because the power output is adjustable from about 10 Watts to 100 Watts. The control for this is located behind a plastic protective covering.

This rig was equipped with an HM-12 scanning hand microphone. This mike has up and down buttons so you can scan up through the rig's memories or through a range of frequencies and then scan back down through them again. Audio reports from other stations indicated the rig's SSB and FM audio were very good.

The power control and the others—VOX, VOX gain, anti-VOX, rf gain, ALC, CW and AM filters, CW break-in, and electronic keyer—have been grouped in a central area, which is a new idea for ICOM. These lesser-used controls are grouped into one area where they are easily accessible. However, once you've set them, you can close the panel and forget them. It certainly cleans up the front control panel of the IC-735 and leaves only the necessary controls in plain sight.

Operating Notes

After looking at other ICOM transceivers recently, I can say I like the design of the IC-735. It has everything that is standard on other ICOM HF transceivers—plus AM and FM—but in a cleaner, less cluttered, less confusing package. About the only thing I could detect that has changed between the various ICOM rigs is the lack of an XIT control, which I feel, after using the IC-735 for some time, would be a convenience, but it isn't a necessity.

On the rear panel there's the usual complement of jacks and connectors including the CW jack, an external speaker jack, ALC-Send jacks for use with an amplifier, a transverter jack, and a jack for a separate receive antenna. There are also two accessory jacks which you use to set the rig up for RTTY, among other things, and there's a special serial port through which you can interface a personal computer directly with the IC-735's microprocessor.

One of the biggest changes you'll note in the IC-735 is the lack of a heat sink for the final amplifier. Instead of using a heavy heat sink, ICOM has used a squirrel-cage fan which goes on as soon as you hit the transmit switch. At first, the sound this fan makes is barely perceptible, but, after a few minutes of high-power or continuous-duty operation, the fan automatically increases speed and this becomes noticeable. I found it somewhat distracting. Yes, it was nice to know this cooling capacity was there for the finals, but the rig didn't have to let me know quite so loudly.

According to ICOM, the IC-735 sports a newly developed central processor which gives this unit added flexibility. For example, the memory scan allows monitoring of all different memory channels or only those stored with a particular mode. Programmed scan provides scanning between any two programmed frequencies. Auto-stop scan functions when a signal is received in any mode, while mode-selective scan automatically monitors only those memories which contain frequencies with a similar mode.

This capability, though, does have a drawback, which has been pointed out in many articles and publications in the recent past: The microcoding which drives the central processor is stored in battery-backed RAM. Driven by a five-year lithium battery, the RAM is retained as long as power is applied to it. If the power is lost—a premature battery failure or some other problem—then the programming is gone and you'll have to send this rig back to the factory for reprogramming. ICOM would do well to consider using nonvolatile RAM or PROM storage for the microcode, at least.

Still, this shouldn't deter the average operator from looking at this rig. It's a pleasure to use. Major controls are grouped according to their functions. For example, the mode-select switches—CW, AM, FM, SSB—are all to the left of the protective panel. The noise blanker (whose duration can be set), attenuator, preamplifier, automatic gain control, and speech compressor are all grouped just below the display, to the left of the tuning knob. The tuning controls—kHz, MHz, ham, and scan—are to the right of the tuning knob, and the RIT, notch, and passband controls are to the right of them. The memory and vfo selectors are also in this section.

Using the ham control will allow you to move quickly through the ham bands, while the kHz control allows you to QSY quickly up a frequency range. The MHz control, as its name implies, moves from one frequency range to another in 1-MHz chunks.

One thing you should be aware of when using the RIT control is the fact that the frequency on the display doesn't change as you use it. When the red RIT LED is lit, you can move ±800 kHz. This capability isn't as wide as some rigs I've used in the past, but it is more than reasonable.

Of more importance to me are the notch filtering and passband tuning. With the notch filter alone you can introduce nearly 30 dB of filtering, and the ability to narrow the passband of the receiver is important when you are trying to copy one station out of many. The preamplifier is of benefit here, too, although I suspect it raised the noise floor enough to not only increase the signal of the weak station I was trying to copy, but also the noise level and so it almost canceled the station out.

Design

The IC-735 is a full-featured, compact HF transceiver. The transmitter covers all the WARC bands (10, 18, and 24 MHz). The general-coverage receiver features continuous 100-kHz-to-30-MHz tuning. It has a 105-dB dynamic range with a 70.4515-MHz first i-f circuit. This circuit is able to eliminate nearly all spurious responses because it was designed around two high-quality crystal filters.

Using a direct-feed mixer, ICOM has engineered a rig with a higher spurious-response rejection ratio, higher receiver sensitivity, and a wider dynamic range. The DFM circuit feeds incoming signals directly into the high-level first-mixer stage.

After the first i-f stage, signals are downconverted twice: first to 9.0115 MHz and then to the standard 455 kHz. The rig remains rock stable at all times. Our testing is pretty much in agreement with the published stability figures for the IC-735—less than 200-Hz drift one minute after turning it on, less than 30 Hz after an hour, and less than 500 Hz over the temperature range of 0° to 50° C.

That the IC-735 is a quality rig is easily seen from its specifications. For example, with the preamp on, its SSB/CW sensitivity is less than 1.0 uV for 10-dB S/N from 0.1 to 1.6 MHz. From 1.6 to 30 MHz, it's less than 0.15 uV for 10-dB S/N. In AM mode, using the narrow filter, its sensitivity is less than 6 uV for 10-dB S/N from 0.1 to 1.6 MHz and less than 1 uV for 10-dB S/N from 1.6 to 30 MHz. FM sensitivity from 1.6 to 30 MHz is less than 0.5 uV for 12-dB Sinad. Squelch sensitivity is 0.3 uV on FM.

Selectivity is also good, as shown in the specifications—see box on the preceding page.

Spurious and image-response rejection is greater than 80 dB and notch-filter attenuation is greater than 30 dB.

On the transmit side, harmonic output was more than 40 dB below peak power output and spurious output was more than 50 dB below peak power output. Carrier suppression was more than 40 dB below peak power output and sideband suppression was better than 50 dB down.

Overall, the IC-735 is a good rig. It seems to represent a new direction for ICOM: new microprocessor, new microcode, new display, and smaller packaging. The trend it represents is a trend toward simplicity and ease of use. It easily achieves those aims and it turns in excellent performance to boot.

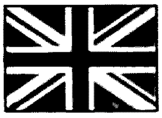
Finally, its instruction book is fairly complete, although some of the writing could be improved. It presents you with a description of all of the salient features of the rig, some theory, and some nice cutaways of the rig, as well as a huge, but very detailed, schematic. I think the manual could be more comprehensive, especially in the theory of operation area. But, most operators should find the documentation more than adequate.

Marc Stern N1BLH
Framingham MA

73 INTERNATIONAL

Each month, 73 brings you ham-radio news from around the world. In this collection of reports from our foreign correspondents, we present the latest news in DX, contests, and events, as well as keep you abreast of the technical achievements of hams in other countries.

If you would like to contribute to your country's column, write to your country's correspondent or to 73 Magazine, Pine Street, Peterborough NH 03458, USA, Attn: Perry Donham KW1O.



GREAT BRITAIN

Jeff Maynard G4EJA
32 Waldorf Heights
Hawley Hill, Camberley
Surrey GU17 9JQ
England

I am able to open this report with some really good news that reflects the excellent work done by the Radio Society of Great Britain in representing the UK radio amateur population. The UK is to be the first country in Europe with a permanent (i.e., 24-hours-per-day) allocation in the 50-MHz (6-meter) band.

The Minister of State of Industry and Information Technology, Mr. Geoffrey Pattie, recently made a statement in the House of Commons about the future plans his department has for that part of the VHF spectrum known as Bands I and III. His statement included the following definite reference to 6 meters.

> ...I am conscious that the interim Merriman Report recommended that the radio amateur service should be given an allocation in the Band I and I am therefore proposing to fulfil that recommendation by allocating the band 50 to 50.5 MHz to radio amateurs.

You will recall that to date there has been some 50-MHz activity in the UK with a selected population of amateurs having access to the band at certain times of the day.

A great deal of work will have to be done before allocation is made generally available and it may be some time before the band gets crowded! Not the least of the problems is that a number of European countries still use Band I for broadcasting and their interim needs must be considered.

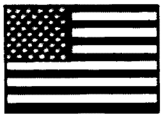
Anyone wishing to get the very latest news on this and other UK amateur-radio topics should call the RSGB's Headline News Service on 0707 59312 (the full code from the US is 1-44 707 59312).

A 50-MHz allocation available full time and to all UK operators should see some interesting propagation modes at this frequency which have not yet been fully explained.

The RSGB 50-MHz beacon, GB3NHQ, has been heard regularly on the east coast of the US. Just think what can be done with more power and some stacked beams!

The UK administration has recently decided to open up the air to youngsters aged 10 and up (previously the minimum age was 14). A full license is not available to anyone under 18; however, once the Morse test and Radio Amateur's Examination are passed, the ten-year-old can operate any station under supervision of the license holder.

By the time you read this, I will have moved house. The good news about the new location (30 miles west of London) is that it is on top of a hill with some tall trees to the rear. The bad news is that the tower is not moving. I have been persuaded that tree-born wire antennas are sufficient although I have a sneaking desire to turn to satellites as the way of achieving DX.



GUANTANAMO NAVAL BASE

Tim Miller KG4TM
Det. Guantanamo, Box 22
FPO New York NY 09593

Although you might not believe it, amateur radio is alive and well at the US Naval Base in Guantanamo Bay, Cuba.

The population of the naval base is currently about 7000 people, with fewer than 10 licensed hams. Among that group, we have everything from Novice- to Extra-class licensees.

One of the unique things about being a ham down here is that we do not fall under direct FCC jurisdiction. Our licenses are issued by the US Naval Base. In order to receive a KG4 call, a valid FCC license is required. After some simple paperwork, a KG4 call is issued. You may select your own suffix, providing it is two letters long and is not currently active. Thus we have the KG4 "2 by 2" call-letter assignment.

Along the same lines, our frequency allocations do not follow the standard FCC band plan. We are permitted to operate SSB in many parts of the US CW bands. It is therefore perfectly legal for us to operate SSB in the 15-meter Novice band.

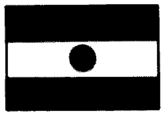
Guantanamo Bay (or Gitmo, as most of us call it) is different from most other DX areas. We are on a 48-square-mile rock with little more than coral dust to drive ground rods into. Making matters worse, our average rainfall places us in the arid zone, with most of the rain coming all at one time during the rainy season. The 90-degree temperatures then bake the ground to a rock hardness. It is sometimes a challenge to install a good grounding system!

One of the continuing problems we have at Gitmo is the high turnover of personnel. The average length of stay is 12 months if you are single or 24 months if your family is along for the tour. If you are a civilian, like myself, your tour is indefinite. It is therefore very difficult to keep an organized club station going, not to mention the headache of QSL cards getting to the proper person.

Our QSL manager, Charlie Campbell KG4CC, is always busy trying to forward all of the KG4 cards. It is a never-ending battle with the number of people entering and leaving Gitmo! So please be patient with respect to cards from Box 73. It sometimes takes a while to forward your cards to the proper place!

Guantanamo Bay may be isolated, but amateur radio keeps us in touch with the rest of the world. Some of our air time is spent running phone patches or schedules back to the States. Please respect our frequency at this time and refrain from breaking in for a signal report. Hearing from our families means a great deal to personnel down here, and the QRM just adds to the problem!

Until next time... Have a great day from Guantanamo Bay!



INDIA

Miss R. Subha
3, Thiru-Vi-Ka Road
Post Box 725
Madras 600006
India

Once every couple of years, Indian hams congregate for what is a giant eyeball QSO, educational program, and business meeting all rolled into one. The 6th All India Amateur Radio Convention (as I write this) is scheduled for the 24th and 25th of August, 1985, at Madras, the third largest city in India. It promises to be a memorable event. [For those who read this long after the event, consider it a preview of the style of the 7th Convention in 1987!]

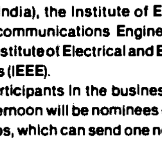
This convention, which we expect to be inaugurated by Mr. Rajiv Gandhi VU2RG, Prime Minister of India, will be the meeting point for nearly a quarter of all the licensed amateurs in India. The first day will see a number of lectures with demonstrations on *avant garde* techniques such as AMTOR, packet switching, SSTV, and computer-oriented activities. Also to be discussed are the more mundane topics such as the QSL Bureau and the licensing system.

In a high-tech contrast to the traditional technical programs, the second day begins with a seminar on "Communications in the Year 2000," with emphasis on space communications. Scientists and hams from the Indian Space Research Organization (ISRO) will play a prominent part in this seminar, which is cosponsored by the Institute of Engineers (India), the Institute of Electronics and Telecommunications Engineers (IETE), and the Institute of Electrical and Electronics Engineers (IEEE).

The participants in the business meeting in the afternoon will be nominees of the affiliated clubs, which can send one nominee for every 50 members or part thereof. The giants among these clubs are the founder societies, the Radio and Electronics Society (Bombay), the Madras Amateur Radio Society, and the Bangalore Amateur Radio Club. They will elect a new executive committee and a new president to succeed M. V. Chauhan VU2MV. Indications are that there will not be many takers for this position, which now requires a large share of the incumbent's time.

The registrants not attending the business meeting will view a program of ARRL and WIA videotapes. The valedictory session will begin with the introduction of the new team which will lead the Federation for the next two years and will end with a valedictory address by a prominent engineer-ham.

The convention will make it possible for the registrants to match callsigns and voices with faces. With hundreds of new callsigns active on the bands, this could indeed be a memorable experience.



NEW ZEALAND

D. J. (Des) Chapman ZL2VR
459 Kennedy Road
Napier
New Zealand

A few years ago, the NZART Council decided to centralize its headquarters in Upper Hutt, near Wellington, and leased office space in a city building, Astral Towers. There, it set up the HQ office under General Secretary Neville Copeland ZL2AKV.

In the ensuing years, the operations of NZART HQ have outgrown the original office suite, and recently the landlords offered increased space on the sixth floor, almost doubling our HQ floor space to 768 square feet. The offer included (at the owner's expense) the erection of an attractive new entry to the NZART office from the lift lobby and the provision of carpet, lighting, and partitions to meet NZART requirements. It was too good to refuse, and the Council accepted the offer last November.

Relocation took place in February/March, 1985, with the General Secretary and a team of Upper Hutt amateurs doing the necessary stripping down, shifting of office furniture, reerecting of shelves, and relocation of stock and records. GenSec Neville left the workers in no doubt that he could use hammer and screwdriver equally as well as he could pound his typewriter or, indeed, his Morse key.

The relocation has allowed more space for storage of records, a larger area for the display of publications, and also a feature area for the display of the NZART Honors Board, contest and awards trophies, and general memorabilia.

INCREASE IN LICENSE FEES

Commencing 1 July this year, ZL amateurs will have to pay more for their annual license—it now will cost NZ$20.00 (approx. US$40). The Amateur Operators Certificate Examinations will be NZ$15.00 and the Morse Operating Test only, NZ$7.00.

The NZART Council objected very strongly to the increase in our license fee by 54% to the regulatory body, the NZ Post Office, without any success. So ZL amateurs will be paying more for the privilege of being able to operate on the ham bands from July this year, but I don't think the increase will have any detrimental effect on the hobby. I get a reprieve myself, as my license fee is not due until April next year, the anniversary of the date I received my amateur certificate in 1948.

A CHANGE AT THE TOP

At the NZART Annual Conference in Christchurch in June this year, retiring President Don Mackay ZL3RW handed over the gavel to incoming President Terry Carrell ZL3QL, and we of NZART look forward to an exciting period with him. Terry is an airline pilot, a businessman in electronics, and an enthusiastic amateur operator, interested in many facets of the hobby, including satellites and packet radio.

IARU REGION 3 CONFERENCE

Organization is well under way for this important international event to be held November 13–17 at the Rose Park Hotel in Auckland. Already papers have been received on a multitude of topics; the final selection of papers to be considered at the conference will rest with the NZART Council. At present the list of papers includes a report from NZART, information on preparation for the next WARC, the band at 10.1 MHz, international beacon projects, common licenses and international standards, the Region 3 Award, "Pirate Operators and Improperly Licensed Stations," "Misuse of Amateur Radio by Amateur Stations," "A Band Plan for the 28-MHz Band," "Standardizing on USB on all bands," and "Inexpensive Equipment for Developing Countries."

NON-MORSE OPERATORS—THEIR VALUE TO NEW ZEALAND

In conjunction with the IARU Region 3 Conference, the NZ Post Office has granted permission for the following concession to amateurs from overseas representing their

countries at the conference. They will be granted a temporary amateur transmitting license for the period 10-30 November for VHF hand-held transceivers provided those representatives and delegates hold a current amateur license issued by their administration, even if that administration does not have reciprocal licensing arrangements with New Zealand. Representatives from countries that have reciprocal licensing arrangements with New Zealand will receive the normal privileges appropriate to the qualification they hold in the same way as they would with a normal application for reciprocal licensing arrangements.

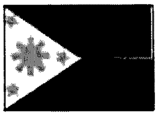
To provide some distinctiveness for these special licensees, callsigns will be allocated from the series commencing ZL0ZAA. It will be the first time all representatives and delegates to an IARU regional conference have been licensed to operate on the bands, even though on a restricted basis. Indeed a unique occasion, a concession which should be important to the hobby as a whole, and a very convenient arrangement for the delegates and representatives from our overseas fraternities.

Special ZM Prefix

In recognition of the importance of this conference to ZL amateurs in general, the New Zealand Post Office has given approval for the use by licensed New Zealand amateur stations of the ZM prefix for the period 1 October 1985 to 31 December 1985 inclusive.

Special Conference Station, ZM6ARU

The operation of a special club station in association with the conference using the callsign ZM6ARU for the period 9-18 November was also approved by the ZL regulatory body.



PHILIPPINES

Leo M. Almazan WA6LOS/DU2
10098 Knight Drive
San Diego CA 92126

Hello again, everyone, I am back again in DU-land. Here is a belated report!

Before departing San Diego, I received three copies of *The Amateur Radio World* from DU5-land. It seems that this fine magazine is what the amateur-radio community in DU-land needs; it is informative and provides for the needs of the local ham population in both technical and general ham information.

I arrived Christmas Day and was whisked out of immigration and customs in record time. No hassle and no baggage check! What is more amazing is that I also made the 65-mile journey from the airport to Clark Airbase in record time. There was no traffic in sight! Guess I timed this one right.

I immediately went to 145.70 MHz to let the guys know that I was back in town. Dodo DU2CCK and Ralph KA6BBK/DW2 were there to greet me. I was told that our club-station license was up for renewal, which meant reinspection of the station and the station's log by inspectors from the National Telecommunications Commission. Yes, gang, this is done every year. Since I left, the club station (DX2F) was moved from the Carmelite Hospital to the present site at Dungca's Furniture Store, about a mile and a half away. Tony Dungca, who is awaiting his license to operate, has graciously let the club site be one of his unused offices.

The club station consists of an old Heathkit DX-20 transmitter and vfo and an ever-reliable Drake 2B as the station receiver. The HF antennas are multi-element dipoles for 40, 20, and 15 meters. For VHF, the club has a Yaesu FT-290 and a home-brew/hybrid repeater and various VHF antennas. The repeater was operational in 1983 but was out of service in the latter part of 1984 due to lack of spare parts. (Spare parts are hard to come by here in DU-land; they have to be ordered from the US, and sometimes it is easier to order it by asking anyone going to the States to buy the parts on their way back to DU-land!) The club is contemplating whether to buy or fabricate a duplexer so that only one antenna would be in use so that some of our repeater-related problems would be solved. (Any club or individual back stateside care to donate or sell a used one, by any chance?)

Speaking about repeaters, Engr. San Juan of the National Telecommunications Commission has drafted the mechanics of repeater regulations, frequency allocations, and procedures to be used by his office to inspect a licensed repeater operation in the country. I have met Engr. San Juan on many an occasion, and he has told me that most of the club repeaters in the country are "illegals." He added that most of them have filed applications but have not been inspected yet by his office—and until they have passed their inspection, they are not allowed to operate.

This year marks the 52nd anniversary of PARA (the Philippine Amateur Radio Association). The 22 radio clubs affiliated will be in attendance for a meeting at the Quezon City Sports Center. DU7DP, the incumbent president, has promised an afternoon and evening of the usual dinner/eyeball and also a meeting "about something." The "something" will be the much anticipated restructuring of the still-unresolved national organization. I would like to see solidarity rather than the PARA vs. PCARS debate. I believe that resolving this problem would foster not only solidarity among the DU hams but also get the wheels rolling for solving other important problems besetting Philippine radio amateurs.

Another thing to come out of the "Grand Eyeball": a proposal for a hamvention chaired by our indefatigable friend Raul Duque DU1QUE, who is also known in DU-land as Mister Repeater, for obvious reasons. The last hamvention was held in Metro-Manila in 1983. Raul and his dynamic group made it successful, and this one, to be held in Quezon City sometime in February, may be even more promising and exciting, to say the least. I guess DU1QUE has earned himself another title—this one being "Mr. Hamvention."

The informal Mabuhay net at 14.265 MHz was back again at 1400Z during the late spring and summer when atmospheric conditions were much better. But the favored time was usually around 2230Z, where WB5LBJ/DU6 and company were on frequency to accommodate anyone wishing to land a DU QSO.

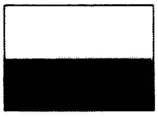
DU1JMG THE BOUNCER

Jose Mari Gonzalez has been a ham since the late 1960s. He has been the president of the Philippine Amateur Radio Association twice in the past, and currently is the DU-land IARU Region III representative. Joe is very active in all facets of ham radio—satellite, RTTY, slow-scan, and DXing. He used to be an avid contester, but because of his recording business obligations, he is now just content with checking into the SEANET and the infomal Mabuhay net. But when time permits, usually in the early daylight hours, Joe will occasionally work European DX, creating pileups for several hours.

DU1JMG has been instrumental in the current license structuring of the DU hams. The current DU/DV/DW prefixes (which represent the license class of the operator) were a result of these changes. Joe and his gracious and beautiful XYL often have entertained visiting overseas hams and often accommodated them in their home QTH. DU1JMG has been the unofficial and Official Observer of the DU airwaves, especially on 2 meters, where there are a lot of illegal operators. He can often be heard giving stern warnings to illegal intruders—hence the nickname, "The Bouncer."

Joe has been in the international limelight lately because of his technical expertise in audio and video technology. He has been retained by the court and commission investigating the assassination of Benigno Aquino, the opposition leader of the Philippines. His current testimony and video and audio enhancement of the many tapes made during the assassination by different press and wires services have contradicted the government position and explanations of the assassination.

Jose Mari Gonzalez DU1JMG, past president of PARA and currently the Philippine representative to IARU Region III.



POLAND

Jerzy Szymczak
78-200 Bialogard
Buczka 2/3
Poland

Fifty-five years have already passed since the General Meeting of PRAA took place on February 22, 1930. The meeting gathered 150 deputies representing 352 members of Polish radio amateur clubs. Among the delegates were a few licensed senders, and others were unlicensed senders and monitors. Promoter of the meeting was the Radiotechnical Institute. The first president of PRAA, not-long-ago-deceased Professor Engineer Janusz Groszkowski, was elected at this historic assembly. The General Meeting of Promoters was a second milestone of development of PRAA after the First Congress of Promoters of IARU in 1925, where a Polish delegation was present.

Sixty years of existence of ham sport in Poland were marked with good and bad times, but a continuous development of shortwave technique. Polish hams began their work on devices with triodes, and now some of them have at their disposal contraptions with microprocessors. They have tasted different operators' techniques: CW, AM, SSB, RTTY, SSTV, and establishing contacts by reflections from the moon and through artificial satellites.

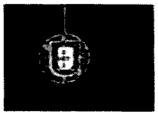
Polish radio amateurs have many remembrances of their activity, among other things priceless documents of the joint action with the Allied Nations during the Second World War. The district board of PRAA in Katowice as a first in Poland appointed an Historical Commission with an objective aimed at the compiling of documents and tokens of remembrance. Unfortunately, difficult housing conditions at PRAA headquarters in Warsaw hindered setting up a central museum until now. But nevertheless, a new history of Polish radio amateurs should be available in the future. To pay honor to the best Polish radio amateurs, the best clubs are to be given the names of these hams. The callsigns of famous Polish radio amateurs will not be awarded to anybody.

One of the most active and meritorious Polish hams, the vice-president of PRAA, Juliusz Schmidt SP3AUZ, died on October 27, 1984. He was a born ham, a DX-hunter. Among his numerous public initiatives we can call to mind was the SPDX Conference in Nowa Sol (his native town), organized by him.

So much history! Who will conduct this necessary and useful work next? There are already 5,050 licensed individual hams and 468 club stations in Poland. Among them are many hams engaged in research and development of this fantastic sport. The "Development Fund of Radio" has been set up lately. It will give financial aid to weaker clubs and promote investments.

Polish amateurs have taken part (or will) in the following international radio amateur contests this year:

1. SPDX Contest (CW) 6-7 April.
2. *CQ* WW WPX Contest (CW) 25-26 May.
3. *CQ* MIR (M) 11-12 May.
4. All Asian Contest (SSB) 15-16 June.
5. IARU Radiosport (M) 13-14 July.
6. WAE DX Contest (CW) 24-25 August.
7. All Asian DX Contest (SSB) 24-25 August.
8. WAE DX Contests (SSB) 14-15 September.
9. *CQ* WW DX Contest (SSB) 26-27 October.
10. *CQ* WW DX Contest (CW) 23-24 November.



PORTUGAL

Luis Miguel de Sousa CT4UE
PO Box 32
S. Joao do Estoril 2765
Portugal

Hi!

This time we start with visitors in Lisbon. It is always nice when we have close encounters with old friends.

Last April, we had Frank Rose W1TIV

and his lovely wife, Irene, down here with us. We were very happy for that. Frank is an old friend and we've had a good meeting here. He is one of the few foreign hams who has talked to 468 Portuguese stations (381 cards received), with the following score:

Portugal (CT1/CT4)—244 contacts, 199 confirmed.

Azores Is. (CT2)—35 contacts, 30 confirmed.

Madeira (CT3)—14 contacts, 12 confirmed.

Angola (ex-CR6)—160 contacts, 87 confirmed.

Mozambique (ex-CR7)—59 contacts, 52 confirmed.

Cape Verde Is. (ex-CR4)—10 contacts, 8 confirmed.

S. Tome Is. (ex-CR5)—2 contacts confirmed.

And 1 confirmed contact each for Ex-Portuguese Guinea (ex-CR3), Timor Is. (ex-CR8), Goa Is. (ex-CR8), and Macau (ex-CR9).

Well, of course this is a big score for a foreign station, not to mention the dozens of awards he has around the walls, and some plaques too.

While in Lisbon, Frank and Irene visited some interesting places, met old friends, and were in the southernmost province, the Algarve, for a short visit. There is a lot of Moorish influence in architecture and folk dress as well as in Arabic words in the local dialect. They enjoyed the local cuisine, and loved the Portuguese sardines, anchovies, and other good dishes of that area. We loved having Frank and Irene with us, and we will wait for another trip.

If yours is a family of water sports, it isn't easy to find a better place for you. While there, ask for "medronho." However, don't drink too much or you will be the best singer in the world. (HI.)

SILENT KEY

With great regret we were informed that Jaime Gracias CT1OF, known as Jim, passed away last April. Graduated in Electrical Engineering, Jim was very active on the bands almost every morning. In amateur radio for many years, he was elected to the presidency of REP (Rede dos Emissores Portugueses) for about three years. Jim also managed the following duties: QSL manager for the Portuguese Bureau as well as VHF manager, a member of several working groups, and finally, a liaison officer for IARU. He always accepted all those duties with great respect and a sense of responsibility.

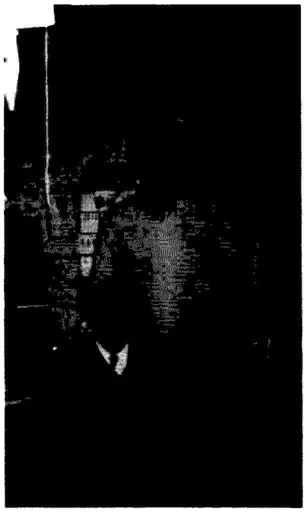
Wa shall miss hearing Jim calling CQ on the 20-meter band early mornings.

60 YEARS OF BROADCAST RADIO IN PORTUGAL

Celebrating the 60th anniversary of broadcast radio in Portugal, an exhibition was held last May in one of the new Post and Telecommunications buildings known as Forum Picoas, or Edificio das Telecomunicacoes, situated halfway between Saldanha and Marques de Pombal, opposite Lisbon's Sheraton Hotel (if that helps), the nearest tube station is Picoas.

Forum is just the finest thing we have connected with the Department of Telecommunications. It is a fine piece of architecture. There, several activities are held during the year; it is also used for congresses, mini-exhibitions, for demonstration purposes, general meetings, etc. Beyond all this, a complete media service might be used by the congress. The services are video projections, video recordings, translating machines, telex, phones, reprography, and a first-class secretariat. For break times, we have a coffee shop with superb meals.

Forum is open seven days a week, Monday to Friday 3:30 am to 1:00 am, and Saturday, Sunday, and holidays 11:30 am to 1:00 am (local time).



Frank Rose W1TIV sitting, and CT4UE. (Photo by CT4UE)

In one of the showrooms of this building we had a chance to observe an exhibition celebrating the 60th anniversary of broadcast radio in Portugal. In this event several antiques were shown, and we could recall the old days of radio activity. An updated version of a compact laser disk could be seen, too.

In a quick visit, we appreciated the following apparatus. I know, guys, that some of you would like to have these things in your shack. (HI.)

- A recording machine made by Presto Recording Corp., type GN series 01976.
- A magnetic horn for public address, made in 1930 (5 feet high).
- A recording machine made by Telefunken, mod. 79, sold in 1957.
- An old but nice Gramophonograph, Edison standard, model A, made in 1903.
- A Lioretgraphz phonograph, spring drive, made in 1894.
- A Philips microphone, N. 4210, made in 1930 (as big as your linear amplifier).
- A Stern radio receiver, model 2444g, made in 1929.
- Another nice receiver made by Murphy, series N. 266618.
- A real antique Scott receiver, series E 692, 5 × 4 ft.
- A crystal-set receiver WISI made, probably in 1935. (This was a simple form of receiving apparatus in the early days of broadcasting, using a crystal touching a metal wire as the rectifier.)
- A superheterodyne receiver made in 1929.

Well, it was an interesting event—just to remember the old days of the beginning of this century. Believe it or not, some of those wooden boxes were "portable." As a final comment, we saw a homemade receiver built in an empty ham can! This was made by CT1FT back in 1937.

ARCL

Once again, we are giving some more news of another association of radio amateurs we have, near Lisbon.

ARCL stands for Associacao de Radioamadores do Concelho de Loures. This association was founded January 27, 1963. At the time of this writing, 62 members are listed, all of them with a big amount of enthusiasm to carry on the several activities during the year. A few contests were made on VHF and HF, the last one with great success.

Back in 1983 they went on a DXpedition to Serra da Lousa (Lousa Hill), and from there they worked many stations on VHF and have made a 30-minute movie showing all the ham activity while on the Hill.

During this year a permanent award was issued known as Diploma Verde da ARCL, sent to all those who carry out the following rules:

Valid contacts with stations in the municipality of Loures using permitted ham frequencies in the following modes: CW, AM, and SSB, with different awards for each mode.

Contacts with mobile or portable stations will be valid, but only with hams living in that municipality.

Only contacts made after the 27th of January of 1985 will count for this award.

To apply, please send a certified list of contacts (list may be certified by a club station or three licensed radio amateurs).

When sending the logs, remember the operator's name, QTH, callsign, date of the contact, time (UTC), and transmission mode.

Awards will be sent free of charge for hams living in Portugal, Madeira, or Azores only. All the others, please include 4 IRCs for the mail charges.

Stations located in Portugal or Spain should make a total score of 15 points at least (see below).

Stations in other European countries should make 8 points.

Stations from other continents: A minimum of 6 points is required.

For the SWLs, same as above.

The score is obtained according to the following: ARCL club station, when active, will give 4 points; any ARCL member will give 2 points, and nonmembers living in the same municipality will give 1 point.

Contacts with the same station will not be considered even if in a different band.

For any other info or when applying, send your request to ARCL, PO Box 148, 2677 Odivelas Codex, Portugal.

A visitor in Lisbon. Eberhard DL2MCM, left, with Mike CT4UE. (Photo by CT4UE)

REDE DOS EMISSORES PORTUGUESES

REP has presented its annual report, and we can pass on the following:

Rules: Several attempts were made for changes of a few matters, but they haven't reached any success. The talks between the local administration and REP haven't been very good, however REP's board of directors won't change a single word of the proposals presented for the ratification of the rules.

Due to the increase of the expenses, the membership fee has been increased, since January of this year. This decision was presented in the last General Assembly held in January, and agreed to by the meeting. The association has suffered, however, from delay of dues payments by some members. The total amount due is close to US$1,200.

Special attention was given to VHF and UHF repeaters. Some of these rigs, being worked on right now, will be highly improved for first-class operation in the future. The VHF/UHF repeater groups have been working on this project with great enthusiasm.

The QSL service is up date; distribution is handled as soon as packs are received from the post office. This is a volunteer basis job, and members might get their cards at REP's headquarters almost daily.

Very soon a General Assembly will be held, and among other agenda items will be an election of officers. More on this later.

PORTUGUESE TOP SCORES

The last news (January) tells us that the position of Portuguese hams in the DXCC, is as follows (numbers of countries): CT1FL—331, CT1BH—330, CT1UE—324, CT1RM—317, CT1UA—310, CT1XKA—305, CT3BM—265, CT2CE—253, CT4IB—251, CT4RH—223, CT4NH—219, CT2DF—203, CT2CQ—201, and CT1VY—200.

We were also happy to read that CT1FL is the 52nd ham who received the 5-Band WAZ! A hard job these days.

EDP CONTEST

A celebration of the 9th anniversary of the contest of the EDP (Electricidade de Portugal—the state company that supervises and supplies electricity to the whole country) was held last June, with the special call, CT5EDP. They were active on 40 and 80 meters, too.

VISITORS IN LISBON

Once again I've seen an old friend. Eberhard Schulz DL2MCM and part of his family came to Portugal for their summer holidays. Nice visit, but we almost got in trouble with the German beer that Eberhard brought to me as a gift. The stuff is really good, but in a matter of minutes, wow! HI! HI!

SWEDEN

Rune Wande SM0COP
Frejavagen 10
S-155 00 Nykvarn
Sweden

LOST HAM LICENSE

A recent incident when a Swedish ham got his license revoked on the spot for one year, and his hand-held 2m-FM rig confiscated,

has got the Swedish ham population concerned.

The incident took place at a ham flea market. Representatives from Televerket (the National Swedish Telecommunications Administration = our FCC) were invited to show their mobile unit for sophisticated measurements in the radio field. They also invited flea-market visitors to get their 2m handhelds checked out for possible spurious emissions, etc. This was, so to speak, a public-relation event.

One fellow ham handed over his ICOM 2E to one of the representatives from Televerket, who also is a ham operator. (The E designator means that the unit is a version for the European market and covers 144–146 MHz.) It was noticed, however, that this particular unit was modified to cover 140 through 150 MHz—which is easy to do. Reasons for making this kind of modification could be, e.g., the wish to cover the whole band permitted, 144–148 MHz, with a reciprocal license during an upcoming trip to the USA, the wish to listen outside the ham bands, the intention of using the unit together with a transverter for 432 MHz in order to get proper coverage, etc. On the spot, in front of some twenty other fellow amateurs, this modified unit was confiscated and the owner's ham license immediately revoked for one year.

An unfortunate incident of this kind has been made possible since Televerket revised the amateur-radio regulations in 1981. Previously, a licensed radio amateur could possess any kind of a radio transmitter. It was also quite clear that transmitters capable of wide frequency coverage never should be used outside the authorized ham bands, and used only according to the user's ham license privileges. The changed regulation not only made transmission outside the ham bands illegal (which of course was covered already by the old regulations), but also the *possession* of a transmitter not intended for amateur-radio use was made illegal.

After hard criticism, and realizing that the entire surplus market was closed for Swedish hams, Televerket issued a statement that a surplus transmitter has to be modified to cover only the ham bands within three months from date of purchase. It was also informally said that the intention of this new restriction was to be able to prosecute a licensed ham operator legally who uses illegal equipment and illegal power on the Citizens Band (CB).

Illegal use of the radio spectrum is of increasing concern to us as radio amateurs. We are, of course, in agreement with the licensing authority that illegal use has to be fought against. It is, however, very unfortunate and of much concern to us that the legal methods the authorities tend to use (compare the FCC ban for 20-MHz amplifiers in the USA) may severely restrict what amateur radio stands for, freedom for experiments, and exploration under responsibility.

DEALER DIRECTORY

Culver City CA
Jun's Electronics, 3919 Sepulveda Blvd., Culver City CA 90230, 390-8003. Trades 463-1886 San Diego, 827-5732 (Reno NV).

Fontana CA
Complete lines ICOM, DenTron, Ten-Tec, Mirage, Cubic, Lunar, over 4000 electronic products for hobbyist, technician, experimenter. Also CB radio, land-mobile. Fontana Electronics, 8628 Sierra Ave., Fontana CA 92335, 822-7710.

San Jose CA
Bay area's newest amateur radio store. New & used amateur radio sales & service. We feature Kenwood, ICOM, Azden, Yaesu, Ten-Tec, Santec & many more. Shaver Radio, Inc., 1775A S. Winchester Blvd., Campbell CA 95008, 370-6665.

New Castle DE
Factory Authorized Dealer! Yaesu, ICOM, Ten-Tec, KDK, Kenwood, AEA, Kantronics, Santec. Full line of accessories. No sales tax in Delaware. One mile off 1-95. Delaware Amateur Supply, 71 Meadow Road, New Castle DE 19720, 328-7728.

Preston ID
Ross WB7BYZ has the largest stock of amateur gear in the Intermountain West and the best prices. Call me for all your ham needs. Ross Distributing, 78 So. State, Preston ID 83263, 852-0830.

Littleton MA
The reliable ham store serving NE. Full line of ICOM & Kenwood. Yaesu HTs, Drake, Daiwa, B&W accessories. Curtis & Trac keyers. Larsen, Hustler, Telex/Hy-Gain products. Mirage amps., Astron P.S., Alpha Delta protectors, ARRL & Kantronics instruction aids. Whistler radar detectors. Full line of coax fittings. TEL—COM Electronic Communications, 675 Great Rd. (Rt. 119), Littleton MA 01460, 486-3400/3040.

Derry NH
Serving the ham community with new and used equipment. We stock and service most major lines: AEA, Astron, B&W, Cushcraft, Encomm, Hy-Gain, Hustler, ICOM, Kenwood, KLM, Larsen, Mirage, Mosley; books, rotors, cable and connectors. Business hours 10-7 Monday through Thursday, and 10-5 Friday and Saturday. Rivendell Electronics, 8 Londonderry Road, Derry NH 03038; 434-5371.

DEALERS
Your company name and message can contain up to 25 words for as little as $150 yearly (prepaid), or $15 per month (prepaid quarterly). No mention of mail-order business or area code permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the February '86 issue must be in our hands by December 1st. Mail to 73 Magazine, Peterborough NH 03458. ATTN: Nancy Ciampa.

PROPAGATION

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA								15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40	40		20	15	15	15	15	
SOUTH AFRICA									15	15	15	
U.S.S.R.							20	20				
WEST COAST			80	80	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
SOUTH AFRICA										15	15	20
U.S.S.R.								20	20			

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20					15
PHILIPPINES	15						40		20			
PUERTO RICO			20	20	20	20	20	20				15
SOUTH AFRICA										15	15	
U.S.S.R.									20			
EAST COAST		80	80	40	40	40	40	20	20	20		

G = Good, F = Fair, P = Poor.

NOVEMBER

SUN	MON	TUE	WED	THU	FRI	SAT
					1 G	2 G
3 G	4 F	5 F	6 F	7 F	8 F	9 F
10 G	11 G	12 F	13 P	14 P	15 F	16 G
17 F	18 F	19 G	20 G	21 F	22 F	23 P
24 G	25 G-F	26 P	27 F	28 P	29 F	30 G

Issue #303

OUR 25th ANNIVERSARY YEAR!

December 1985
$2.50 USA
$3.50 Canada

73 for Radio Amateurs

® A CWC/P Publication

International Edition

SPECIAL ISSUE: FM and Repeaters

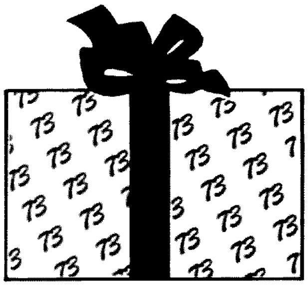
WORLD SSB CHAMPS!

- Results—75 and 160m
- Rules for 1986

HAMS FORM SWOT TEAM

1985 Amateur Radio's Greatest Year?

12
0
A 74470 65946



73 for Radio Amateurs®

ISSUE #303 DECEMBER 1985

On the Cover:
Our holiday "construction project" was designed by Dianne Ritson and Sue Hays. Parts placement diagram by Techart Associates, Amherst NH.

18 FM Your IC-730
Put the icing on your ICOM—and discover why the 10m-FM craze is sweeping the nation! N9DBX

26 Join the SWOT Team!
2m FM is fun, but using a repeater won't challenge your skill. Turn the switch to SSB and find out what ham radio is *really* about! KA3B

38 One-Chip Facsimile
We all *talk* about the weather; now you can *see* it on your Atari. You'll be amazed at how simple it is. WB8TPD

42 NOAA's 2m UFO
Your weather radio is a great signal source on 145.8 MHz. K9POX explains why. K9POX

44 Secrets of Cellular Radio
Take a guided tour behind the scenes of our newest repeater technology. N1BLH

50 The Santee Spectacular
Is your Santec becoming forgetful? Are its batteries going soft? No more! Here are two quick mods that bring your hand-held to within an inch of perfection. W2IVS

52 Saga of the Willie Wand
W5RRH learned a new technique while building this 6-element 2m beam. It's called cut and try and try and try. ... W5RRH

- 4 What?
- 7 QRX—Greatest Year?
- 55 Barter 'N' Buy
- 56 1985 Index
- 59 Special Events
- 60 Contests
- 64 Above and Beyond
- 66 Dealer Directory
- 66 Corrections
- 67, 92 Ham Help
- 68 RTTY Loop
- 68 Letters
- 69 Review
- 72 New Products
- 76 Fun!
- 76 Be My Guest
- 78 Satellites
- 86 *73* International
- 92 QSL of the Month
- 94 Propagation
- 95 List of Advertisers

Editorial Offices: Pine Street, Peterborough NH 03458, phone: 603-924-9471. **Advertising Offices:** Elm Street, Peterborough NH 03458, phone: 603-924-7138 **Circulation Offices:** Elm Street, Peterborough NH 03458, phone: 603-924-9471. **Manuscripts:** Contributions in the form of manuscripts with drawings and/or photographs are welcome and will be considered for possible publication. We can assume no responsibility for loss or damage to any material. Please enclose a stamped, self-addressed envelope with each submission. Payment for the use of any unsolicited material will be made upon acceptance. All contributions should be directed to the *73* editorial offices. "How to Write for *73*" guidelines are available upon request. US citizens must include their social security number with submitted manuscripts. **Subscription Information:** Rates: in the United States and Possessions: One Year (12 issues) $24.97; Two Years (24 issues) $38.00; Three Years (36 issues) $53.00. Elsewhere: Canada and Mexico—$27.97/1 year only, U.S. funds. Foreign surface mail—$44.97/1 year only, U.S. funds drawn on U.S. bank. Foreign air mail—please inquire. To subscribe, renew or change an address: Write to Subscription Department, PO Box 931, Farmingdale NY 11737. Send Canadian changes of address to: 73, PO Box 1051, Fort Erie, Ontario CANADA L2A 5N8. Return postage guaranteed. For renewals and changes of address, include the address label from your most recent issue of *73*. For gift subscriptions, include your name and address as well as those of gift recipients. For questions concerning your subscription and to place subscription orders, please call us toll free at 1-800-645-9559 between 9 am and 5 pm or write to *73*, Subscription Department, PO Box 931, Farmingdale NY 11737. *73 for Radio Amateurs* (ISSN 0745-080X) is published monthly by CW Communications/Peterborough, Inc., 80 Pine Street, Peterborough NH 03458. Second class postage paid at Peterborough NH 03458 and at additional mailing offices. Canadian second class mail registration number 9566. Microfilm Edition—University Microfilm, Ann Arbor MI 48106. Postmaster: Send address changes to *73 for Radio Amateurs*, Subscription Services, PO Box 931, Farmingdale NY 11737. Nationally distributed by International Circulation Distributors.

WHAT? News from the Publisher

The results of our poetry (questionable in some cases!) contest are in. Honorable mentions go to Peter Strauss KO6R (Oakland CA), Paul Danzer N1II (Norwalk CT), Brian Tandrow KR6B (Simi Valley CA), Terry Russ N8ATZ (Massillon OH), Casey Cassin KC7DY (Seattle WA), Verne Smith KA1NAV (Bath ME), and Ed Scallon KA1JSN (Providence RI).

Our $100 prize-winner was written by William Templin KAØDYI (North Liberty IA), who gives special thanks to his wife Susan and his two friends named Steve. Here it is (with our apologies to Clement Clarke Moore), along with our very best wishes for a safe and happy holiday season...

'Twas the night before Christmas, when all
    through the town
The snowstorm was raging, the phone lines
    were down;
The wind it did howl, the tree limbs did crack,
I hope that St. Nick isn't forced to turn back.
The wife making cookies, the kids making noise,
While away in the shack, by my rig I was poised.
The finals were glowing, the mike gain was set,
I was chasing DX to see what I could get.
The bands were all empty, the frequencies clear,
Except one lone station that sounded quite near.
He was calling CQ and my interest did pique,
When he ended transmission with the words,
    "Old St. Nick."
I answered back quickly, I used great dispatch,
If this were St. Nicholas, good God, what a catch!
We exchanged information, it was really
    quite graphic,
Then he came back and said,
    "I've emergency traffic!"
His reindeer were tired, his elves in a grump,
If he didn't land soon, then his sleigh
    he would dump.
I thought very carefully, I thought very hard,
Then I gave him directions to my
    snow-covered yard.
As he flew past my window, his hair like a mane,
He reined in his chargers and called them
    by name:
"Whoa, Anode! Whoa, Cathode! Whoa, Zener!
    Whoa, Diode!
Stop, Heater! Stop, Grid Leak! Stop, Bias!
    Stop, Triode!
You're flying too low! You're flying too fast!
Look out, you dumb reindeer, his antenna mast!"
So into the backyard the reindeer did drop,
St. Nick, the elves, and the sleigh went kerplop!
Then at the back door, I heard this loud knocking,
"Open up in there, or I won't fill your stocking!"
As I turned off the light and was leaving the shack,
Into the house Saint Nicholas came from the back—
His two-meter rig held to his hip with a strap,
"Hams Do It In The Shack" on the front of his cap.
The sack that he carried made his aged
    brow furrow,
And he handed me a card that read,
    "QSL Via Bureau."
His clothes were all sooty, from his shoes
    to his vest;
I felt like a Novice taking his test.
His fingers were calloused and from what
    I could tell,
This came from a straight key that I'll bet
    he used well.
I offered him coffee, I offered him smokes,
I tried easing the tension by telling ham jokes.
Then he nodded his head and raised up his thumb,
He smiled like an Elmer; did I ever feel dumb.
He grabbed up his sack and went straight
    for the tree,
And placed in the pile a large present for me.
When he finished his work he stood up,
    took a bow,
Then out the back door to his team he did plow.
But I heard him exclaim as he flew o'er the land,
"Beware the FCC, friend, we were both
    out of band!"

Jack Burnett

MPA

73 for Radio Amateurs is a member of the CW Communications/Inc. group, the world's largest publisher of computer-related information. The group publishes 57 computer publications in more than 20 major countries. Nine million people read one or more of the group's publications each month. Members of the group include: Argentina's *Computerworld/Argentina;* Asia's *The Asian Computerworld;* Australia's *Computerworld Australia, Australian PC World, Macworld* and *Directories;* Brazil's *DataNews* and *MicroMundo;* China's *China Computerworld;* Denmark's *Computerworld/Danmark, PC World* and *RUN* (Commodore); Finland's *Mikro;* France's *Le Monde Informatique, Golden* (Apple), *OPC* (IBM) and *Distributique;* Germany's *Computerwoche, Microcomputerwelt, PC Welt, SoftwareMarkt, CW Edition/Seminar, Computer Business, RUN* and *Apple's;* Italy's *Computerworld Italia* and *PC Magazine;* Japan's *Computerworld Japan;* Mexico's *Computerworld/Mexico* and *CompuMundo;* The Netherland's *Computerworld Benelux* and *PC World Benelux;* Norway's *Computerworld Norge, PC World* and *RUN* (Commodore); Saudi Arabia's *Saudi Computerworld;* Spain's *Computerworld Espana, Microsistemas/PC World, Commodore World;* Sweden's *ComputerSweden, Mikrodatorn* and *Svenska PC;* the UK's *Computer Management, Computer News, PC Business World* and *Computer Business Europe;* Venezuela's *Computerworld Venezuela;* the US's *Computerworld, Hot CoCo, inCider, Infoworld, MacWorld, Micro Marketworld, PC World, RUN, 73, 80 Micro, Focus Publications* and *On Communications.*

Earthquake

MEXICO CITY was shaken to its knees on the morning of September 20, 1985, when a savage earthquake struck near the resort city of Acapulco. The quake, measuring 7.8 on the Richter scale (followed by an aftershock measuring 7.5), was the worst in Mexican history. For nearly a week the only communication in or out of the country was supplied by ham-radio operators. Almost immediately, an emergency network sprung up on 20 meters, using five channels for incoming traffic and one channel for outgoing messages, including regular news bulletins. Although the US State Department set up a hotline for concerned relatives, it was quickly overloaded and ineffectual. Health-and-welfare messages were forwarded either via the National Traffic System or through independent clearinghouse nets to Mexico. Hams in Mexico would attempt to locate persons over the telephone (when it was working) or through word of mouth. At the peak of the disaster, it took an amazing three days to get word out of the stricken area.

Probably the most significant effect of the earthquake has been the changed relationship between commercial broadcast stations and ham radio. It was readily apparent that all of the major networks were using ham stations for news gathering. In an interview with Fred Maia W5YI, Roy Neal K6DUE of NBC News stressed that using amateurs for commercial message handling was "condoned because there [were] no commercial facilities available. The criterion is 'no commercial facilities available.' " The problem stems from a recent FCC decision which states that in certain cases commercial stations may use hams for news gathering. The Radio and Television News Directors Association (RTNDA) interpreted this action in a rather liberal way, taking advantage of a clause which provides for a "common sense" approach to its use. What's worse, each network has come up with its own way of looking at the rule. The result is a mishmash of conflicting actions and confusion among ham-radio operators. In a telephone interview with *73* Associate Bill Pasternak WA6ITF, FCC Private Radio Bureau Chief John Johnston W3BE claimed that all of the media-related ham activity was illegal. Another FCC staffer said, however, that no measures would be taken against the networks unless a formal complaint was filed with the FCC enforcement branch. Gordon West WB6NOA noted that newsmen were using amateur radio for setting up logistics and discussing union pay scales for their crews while refusing to handle health-and-welfare traffic into the area. Clearly there is a serious problem here. Have the broadcasters gone too far? Or was there a justifiable need for the use of ham radio to conduct their business? Apparently it depends on whom you ask.

Commercialism

IN A RELATED STORY, the FCC has released PRB-2, in which Lee Shoblom K6ADA, President and General Manager of London Bridge Broadcasting, Inc., has asked for direct access to a portion of the 435-MHz band for "noncommercial" news gathering. Shoblom has requested a waiver of the amateur rules to allow him to use fast-scan television on 435 MHz to feed news of community interest to his low-power television station for rebroadcast. The television station has a range of about 10 miles. The main reason for the request is that the cost of microwave relay equipment is too high—and amateur gear is so inexpensive. Incredibly, about 40 hams in the area fully support the idea! ARRL Executive Vice-President Dave Sumner K1ZZ, when notified of the petition, said the matter must be taken under consideration before an official League position could be taken. We here at *73* need no "consideration period"—we are *dead set against* any commercial use of amateur radio, at any time, for any reason.

Oh No, Mr. Bill!

CALIFORNIA SENATE BILL 1431 was defeated in a rather unorthodox manner. Sponsored by Senator Herschel Rosenthal, Bill 1431 would have made it a criminal offense to own, purchase, or listen to any form of radio capable of monitoring the 800-MHz cellular-radio band. Joe Merdler N6AHU met with Senator Rosenthal to explain his fear that law-enforcement officers unfamiliar with radio equipment would not be able to tell the difference between legal amateur gear and illegal scanners. To prove his point, Merdler produced a Yaesu FT-709 and a similar-looking Regency scanner on the table and asked the Senator to pick the "illegal" unit. He couldn't. Merdler emphasized that more harm than good would be done by this law in the hands of untrained enforcement officers. Senator Rosenthal told Merdler that the bill was not meant to encroach on the rights of ham operators, and that he had the utmost respect for amateurs. As a result, what could have been a disaster to hams in California and a dangerous precedent for the rest of the states was averted.

Fire Friends

LOS ANGELES POLICE AND FIRE officials have gone on record as desiring greater access to amateur radio during times of emergency. The recent Baldwin Hills brush fires graphically demonstrated that ham radio could play a key role in the preservation of life and property. In the Baldwin Hills incident, the Fire Department found that they had no way of telling what was happening on the other side of the hill from where they were fighting a blaze. Amateur radio, with its trained corps of skilled communicators, gave the department the eyes and ears they desperately needed.

Academy Hams

NINE HAMS from Los Angeles television station KTTV were recently commended by the National Academy of Television Arts and Sciences (the Emmy people). For their role in KTTV's "10 O'Clock News," which won four Emmys, a Certificate of Commendation was presented to Engineers Tim Gaskins KA6INW, Mert Garlick N6AWE, Dave Hallmark N6DKI, Bert Hicks WB6MQV, Don Halloway WB7ADU, Howard Lang WA6UFM, Bill Pasternak WA6ITF, Charles Rozner WB6SKM, and the station's Technical Operations Supervisor, Robert S. Sudock WB6FDF. KTTV won Emmys for Best Independent News Program, Best Independent Mini-Documentary Series, and Best Spot Coverage of a Same-Day Breaking Story.

FAR Out

THE FOUNDATION FOR AMATEUR RADIO has announced the winners of this year's FAR scholarships: the John W. Gore Memorial Scholarship ($900) to James H. Baker KI4YN; the Richard G. Chichester Memorial Scholarship ($900) to Eugene S. Reilly KA8JIG; the Edwin S. VanDusen Memorial Scholarship ($350) to Richard K. Soper KA2IKV; the QCWA Memorial Scholarships ($600) to Frances P. Horan KA3CJR, Hai T. Nguyen KAØALZ, Carl H. Puckett KA7BWC, John E. Schnupp N3CNL, David J. Schmocker KJ9I, and John G. Sullivan N2DYC; the QCWA Robert S. Cresap Memorial Scholarship ($500) to Douglas Swiatlowski KA2KMT; the Radio Club of America Scholarship ($500) to

James W. Healy NJ2L; the L.R.L. Scholarship ($500) to Diane E. Willemin N8CAY; the A.R.N.S. Scholarship ($500) to Michael Krensavage KA3CUP; the Columbia MD ARA Scholarship ($650) to Christine L. Gray KA3NAK; the Baltimore MD Scholarship ($500) to Eric J. Smith KA3KJO; the Dade Radio Tropical Hamboree Scholarships ($500) to Christopher A. Atkins KA2QWC and David R. German N4FAD; the Lewis W. Wilkinson Memorial Scholarship ($500) to Wayne F. Poole KC4XL. You can get information about next year's scholarships by contacting the Foundation for Amateur Radio, 6903 Rhode Island Avenue, College Park MD 20740.

1985

A PREDICTION: *1985 will go down in ham history as the greatest year ever for amateur radio. Not since incentive licensing was implemented have so many regulatory changes been made to the Service. 1985 also saw the opening of new bands, the emergence of new modes, and the birth of a new DXCC country. This month we'll look back at the events of 1985 that will shape the future of ham radio in years to come.*

● **PRB-1**—In October the FCC ruled in favor of amateur radio in the matter of restrictive antenna ordinances by passing PRB-1. In response to a petition filed in July of 1984, the Commission affirmed its commitment to ham radio and issued a declaratory ruling preempting all local regulations which preclude or significantly inhibit amateur communications. Specifically, the Order stated that such regulations are "in direct conflict with federal objectives and must be preempted."

● **Novice Enhancement**—Probably the most significant proposal to change the Amateur Service came mid-year when the American Radio Relay League submitted a petition aimed at increasing the privileges of Novice licensees. Designated RM-5038, the plan called for an expansion of the Novice ten-meter allocation to include CW, SSB, and data from 28.1 to 28.5 MHz. On 220 and 1296 MHz, Novices would use all emissions with a power limit of 25 and 5 Watts, respectively. The Element 2 examination would be increased from 20 to 30 questions to reflect the new privileges. Action is expected on RM-5038 early in 1986.

● **WARC Bands**—Twelve meters became an amateur band this year. 24.890–24.990 was opened to hams earlier than expected on a secondary, non-interference basis. The first day on the new band became a frenzy of state-working, as many stations garnered WAS-12 Meters in just a few days! Things are a bit quieter now, but the activity level is still substantial. In the same Order, the Commission made the 10-MHz WARC allocation a permanent amateur band.

● **Don't Be A Problem**—Speaking at the 1985 Dayton Hamvention, FCC Commissioner Ray Kowalski cautioned amateurs not to bother the government with all of their petty problems. He pointed out that hams use valuable spectrum, and that the pressures from commercial radio users for that spectrum had become greater than ever. Kowalski reminded those in attendance that the easiest way for the FCC to deal with a "problem Service" would be to simply eliminate that Service.

● **Spread-Spectrum**—Amateur radio's newest mode is spread-spectrum. While the Commission approved its use on 420 MHz and above, a one-year moratorium was placed on spread-spectrum use so that adequate time would be available for the development of amateur standards. Several stations, in conjunction with the Amateur Radio Research and Development Corporation (AMRAD), are experimenting with various systems under an STA.

● **160 Meters**—June was a busy month for the Commissioners. Apparently approving the new WARC band put them in a good mood, and they began to look for other things to approve. Docket 84-874 happened to be on top of a desk, so hams can now use RTTY, FAX, and SSTV on 160 meters. The FCC felt that the limit imposed to protect the LORAN-A radionavigation system was no longer necessary.

● **ZC4 Cyprus**—Early in the year the ARRL approved ZC4, British Sovereign Bases on Cyprus, as a separate DXCC country, nearly 25 years after a treaty establishing the Republic of Cyprus. Contacts with ZC4 made after August 16, 1960, will be accepted for the new country, but only if proof can be made that the ZC4 station was actually on a Sovereign Base (not all were).

It took months to train her but it sure solved the bird problem!

● **Turkey**—Amateur radio in Turkey took off when the Turkish parliament passed a bill allowing hams back on the air for the first time in many years. Four hams came up on 15 and 20 meters almost immediately, and license exams are being given regularly.

● **KL7 Pribilof**—The ARRL Awards Committee overturned the DX Advisory Committee's recommendation to add the Pribilof Islands to the DXCC list. It was the culmination of a ten-year effort to get the Islands onto the list.

● **Clipperton**—The biggest DXpedition of 1985 had to be FO0XX Clipperton Island. Primarily supported by the Northern California DX Foundation, the six-day operations netted over 30,000 contacts on 160–10 meters and nearly 100 satellite QSOs. The expedition cost about $60,000.

● **73 Magazine**—The October, 1985, issue of *73* marked our Silver Anniversary. The event was highlighted by the Silver Eagle Awards, a special "thank you" to the 25 people who most helped *73* in the past 25 years. Each award winner received a chrome-plated Astatic Silver Eagle microphone and our undying gratitude. Also, 52 readers (50 states, one DX, and one District of Columbia) were selected at random to receive copies of the 1986 *Callbook* set. Here's to another 25 years!

● **Dick Bash**—The publisher of *The Final Exam* series of study guides closed the doors on his business this year. His study guides were infamous in the ham community for containing verbatim questions and answers from the FCC amateur license tests. Once the VEC program got under steam and all of the questions were released to the public domain, Dick had nothing to sell.

Auld Lang Syne

YEAR'S END is a good time to thank all of the people who have contributed to "QRX" during the past twelve months. These folks volunteer their time and skills to keep you informed about your hobby: Bill Pasternak WA6ITF and the *Westlink* crew, Fred Maia W5YI of *The W5YI Report*, Paul Courson WA3VJB and the entire staff of the ARRL (including *Gateway* and the *ARRL Letter*), Gus Browning and his *DX'ers Magazine*, Vern Riportella WA2LQQ and AMSAT, and hundreds of hams who have phoned, sent letters, and called the *73* computer with their tales of hamdom. You all are much appreciated.

FM Your IC-730

Put the icing on your ICOM—and discover why the 10m-FM craze is sweeping the nation!

Sergio Cesar N9DBX
5201 Tollview Drive
Rolling Meadows IL 60008

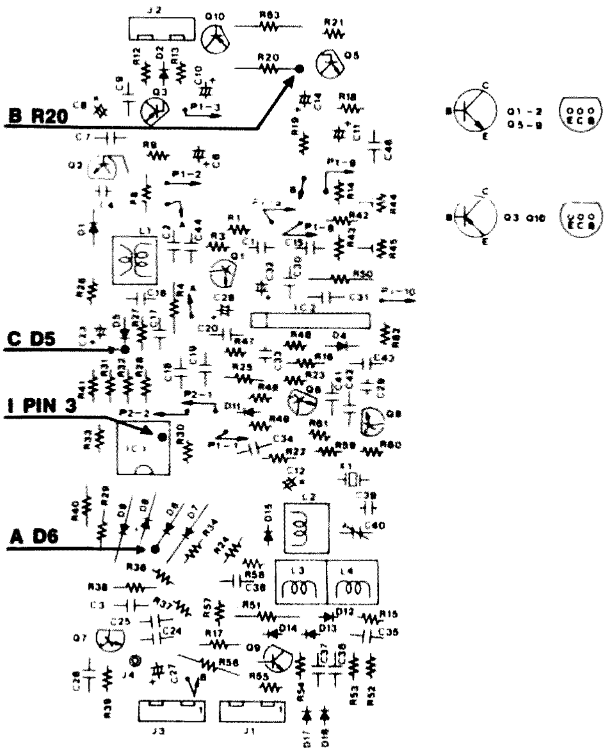


Fig. 1. Detector unit.

For many hams, the ICOM IC-730, by virtue of its compact size, light weight, and many built-in features, is perhaps the ideal HF rig for both mobile and base operation on today's crowded bands. One desirable feature, however, is missing—10-meter FM capability.

A simple FM modulator-detector board can be added to the IC-730 for under $30.00 with no modification whatsoever to the rig. When you are through, you will have an 80-Watt FM transceiver with dual-vfo capabilities, allowing duplex operation for 10-meter FM repeaters and switchable to simplex on any frequency at the push of a button. The circuit described below also includes an option which allows you to maintain the AM operation, if so desired.

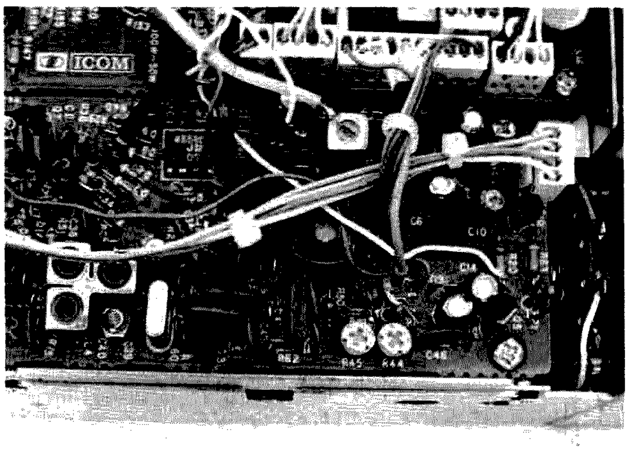


Photo A. Modifications to the detector unit.

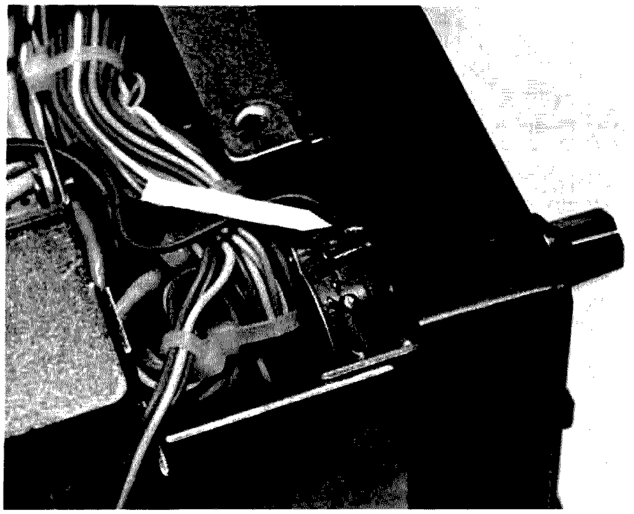


Photo B. Mode switch with AM 8-V wire connected.

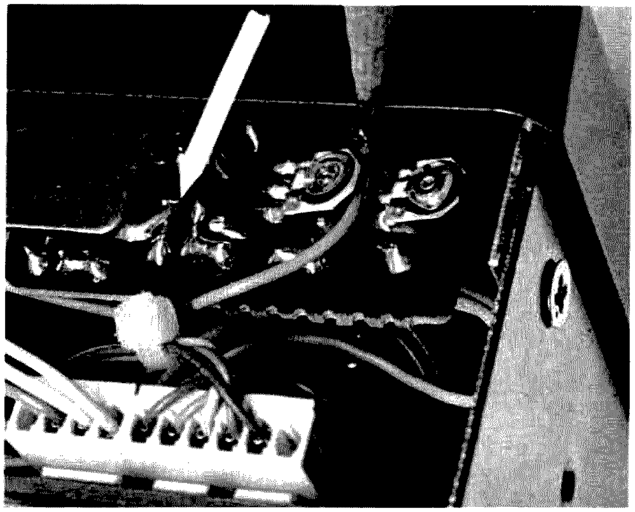


Photo C. RIT board. Arrow shows where REC 8-V wire should be connected. Between the two capacitors, green wire SQ is soldered to the board.

This module can be installed in most HF rigs and Citizens Band radios with excellent results.

The Circuit

The FM detector uses a Motorola quadrature detector, an RCA limiting amplifier, and one transistor as active devices. To receive the FM carrier, an MC3359P high-gain, low-power FM i-f chip was used. This chip was chosen because it was designed for narrowband FM communication and data link and uses a 455-kHz i-f, the same i-f as the 730. It also has a squelch built in so that no added circuitry is necessary.

The 455-kHz i-f from the IC-730 is fed through a ceramic filter 5 kHz or 7.5 kHz wide directly into pin 5 of the 6-stage, limiting i-f (IC1). The 7.5 kHz is recommended for better received-signal fidelity. The i-f has a 3-dB limiting sensitivity of approximately 100 microvolts.

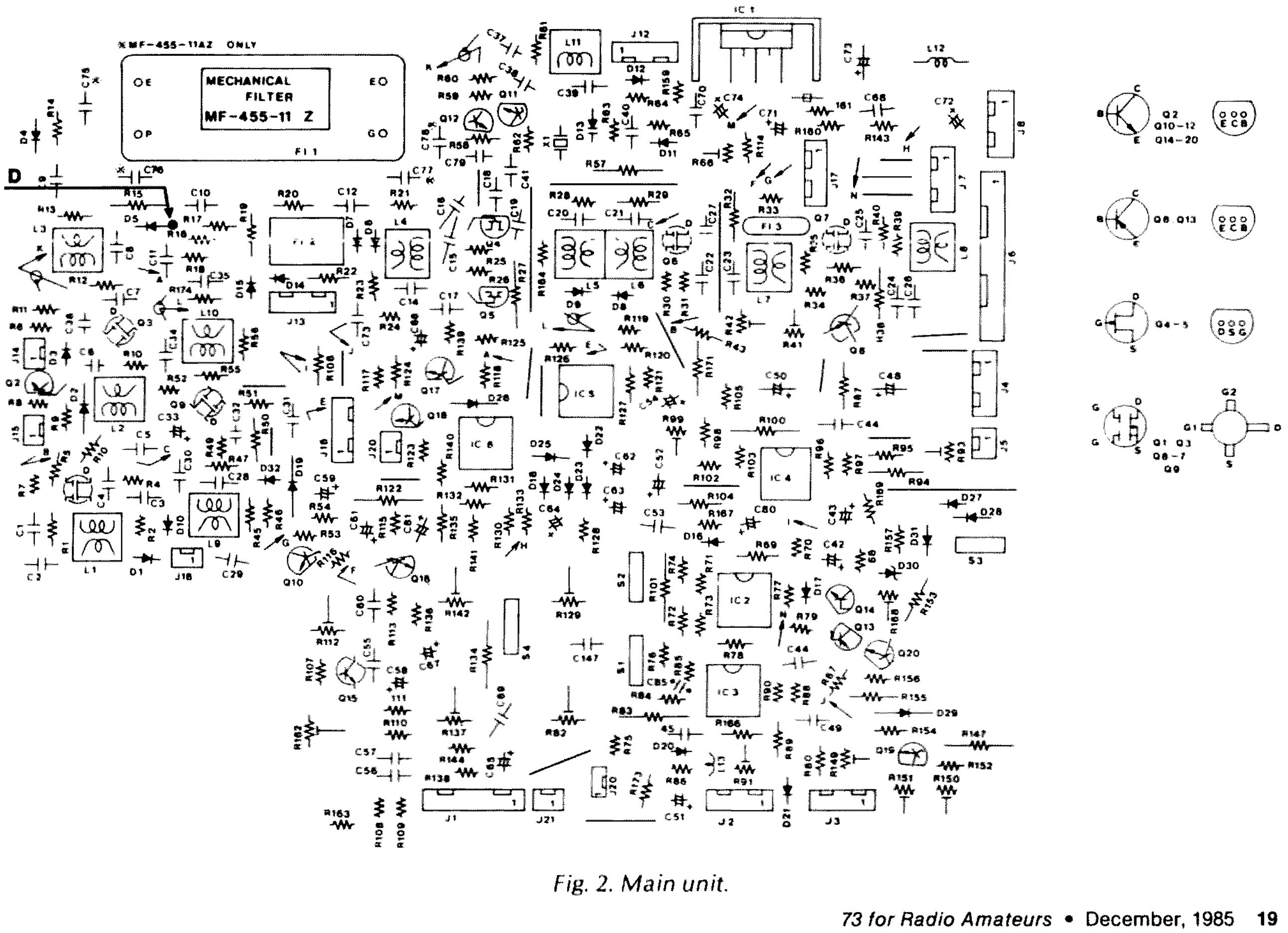


Fig. 2. Main unit.

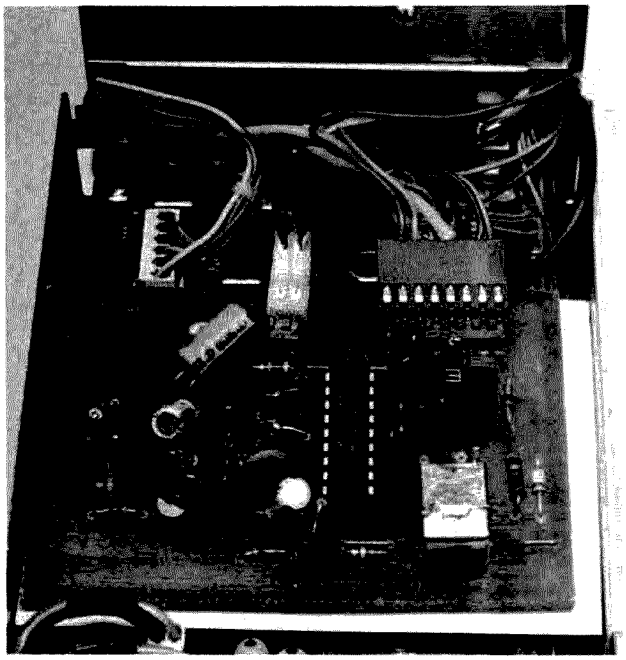


Photo D. Cable routing to converter board.

The output of the limiter is internally connected to the quadrature detector; only a parallel LC network is needed externally to complete the circuit. The detector output is amplified and buffered to the audio output (pin 10), which has an impedance of approximately 300 Ohms. The value of the capacitor off pin 9 controls the amount of de-emphasis.

Squelch

A simple inverting op amp is provided in this chip with an output at pin 13. A filter was made with external impedance elements to discriminate between approximately 7.5 kHz and 8.5 kHz. An external AM detector was used to check the presence of noise above the normal audio, at which point pin 16 shorts to ground the input to the audio amplifier (squelch closed). In the presence of a carrier, the noise level drops sharply, causing the detected AM into pin 14 also to drop, and the squelch will open. Carrier levels as low as .01 microvolts at the antenna input of the IC-730 will open the squelch. For a squelch control, the RIT potentiometer of the rig was utilized. RIT operation is not affected in the SSB and CW modes.

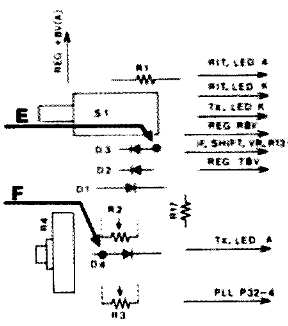


Fig. 3. RIT.

Power-Supply Switch

The only transistor used in the power-supply circuit is to switch the voltage to the modulator chip, SK3223 (IC2). Voltage to power the FM board is taken from the 730's AM circuit (AM 8 V). A 5.6-V zener is used to keep power to the MC3359P constant and in its operating range. Another voltage signal (REC 8 V) is used to switch Q1 off during receive so that any extraneous noise in the shack or mobile will not modulate the vco.

Modulator

To modulate the IC-730, an RCA SK3223 TV/FM sound i-f limiting amplifier is used. Its input from the microphone (pin 6) is amplified, filtered, and fed into the IC-730 vco. Due to the IC's limiting capabilities, it is not necessary to make a mike gain control, but a deviation control is added to its output, pin 3. A .01-microfarad coupling capacitor (C17) was used to connect the modulator to the vco.

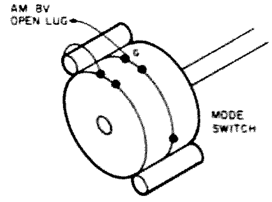


Fig. 4. Mode switch.

The quality of this capacitor, which is also the preemphasis capacitor, will affect the modulation quality. (Increasing its value will produce more bass in the audio; decreasing its value makes the audio sound tinny.) An rf choke is added so that rf from the vco will not be fed back into the SK3223.

The Modification

After the board is completed, it is a good idea to pretest it to make sure it is working properly. Apply 8 V to the board (a 9-V alkaline battery will do). Connect an oscilloscope to the output of the modulator on the $SF2 + $SF1 side of C8. (If no oscilloscope is available, use a small speaker or earphones for adjustment by ear.) Inject a small 1-kHz sine-wave signal to the input and check the modulator for distortions or any malfunctions.

Connect a dc-coupled oscilloscope or a VTVM to the output of the MC3359P at pin 10 and check for approximately 2.5 V dc. A 5-V-dc reading will indicate that oscillation is occurring in the

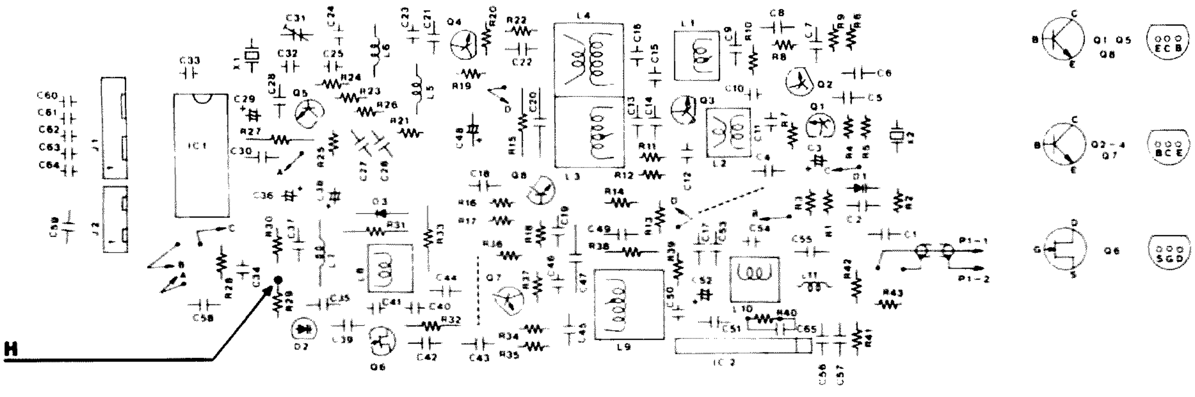


Fig. 5. PLL unit.

Photo E. Connection to mike gain control.

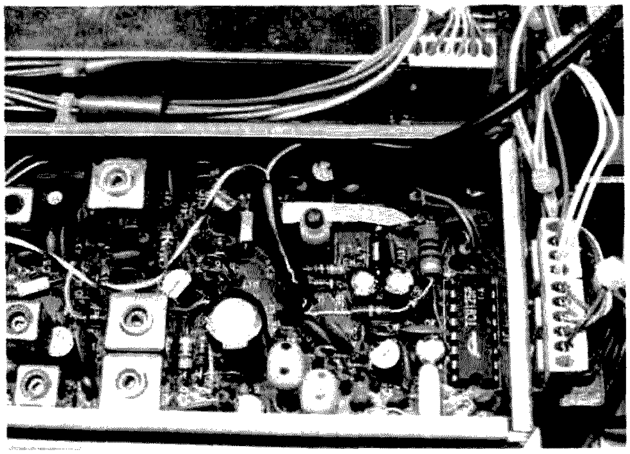


Photo F. Rf choke and resistor soldered to R28.

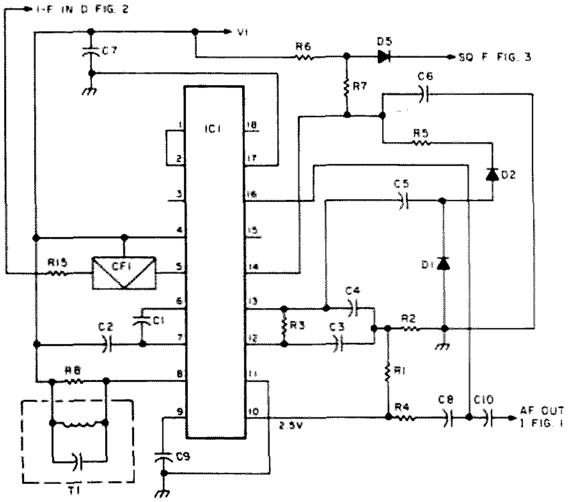


Fig. 6. FM detector.

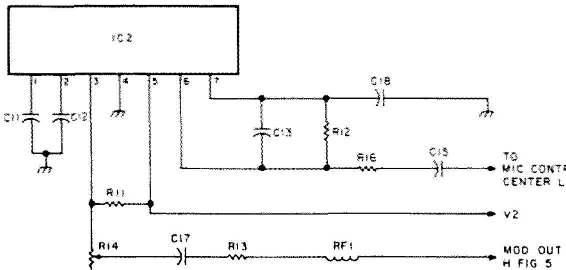


Fig. 7. Limiting FM modulator.

circuit. If this occurs, it is due to lack of shielding on the input side of the chip. It is very important that the 0.1-uF capacitor at pin 6 and 7 be installed as close as possible to the chip.

A ground plane should be provided on that side of the chip, pin 1 through pin 9. A bypass capacitor (C7) can be installed directly across pin 17 (ground) and pin 7, on the foil side of the board.

If an FM signal generator is available, inject a 455-kHz signal to the input of the 455-kHz ceramic filter through the 470-Ohm resistor (R15), modulate the generator with a 1-kHz signal, and you should see a clean 1-kHz at pin 10. If such a generator is not available, make sure there is no dc at the i-f input side of the filter.

Installation and Calibration

Remove all power and cables to the unit. Put a towel on the bench so you don't scratch the cabinet. With the operating manual in hand, familiarize yourself with the layout of the unit. Open it, removing top and bottom covers (don't lose the screws). Find and identify the main unit (top view), manual page 23, Fig. 7-1, rf unit (left side of the rig), page 23, Fig. 7-2, and PLL unit (bottom view), page 24, Fig. 7-3.

1) Install a 150k from D6 cathode to D5 cathode (Photo A).

1a) Install a 10k resistor from D6 cathode to R20 (Fig. 1).

1b) A relay or switch can be installed to open this resistor for AM operations.

2) Solder cable from audio output of MC3359P to pin 3 of IC1 (Fig. 1).

3) Solder cable (i-f signal to MC3359P) center to R17 or D5 anode and shield to L3 can (Fig. 2).

4) Solder AM 8-V wire to mode switch (Fig. 4) open lug (Photo B).

5) Solder REC 8-V wire to RIT board, Fig. 3(E). Photo C, arrow.

6) Route cables to rf unit compartment. Photo D.

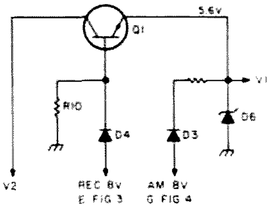


Fig. 8. Power supply.

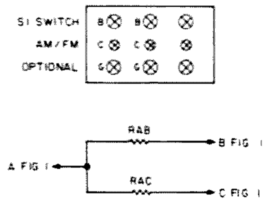


Fig. 9. Optional AM/FM switch.

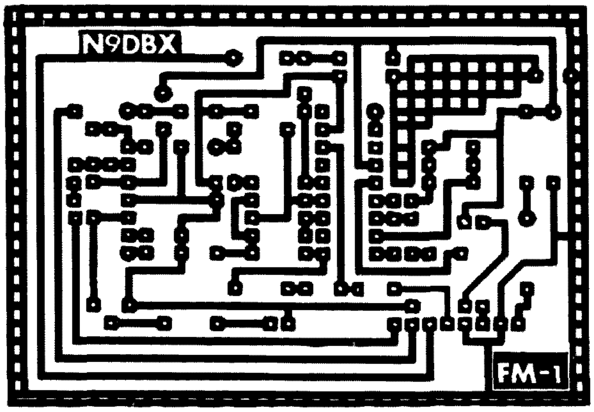


Fig. 10. PC board (foil side).

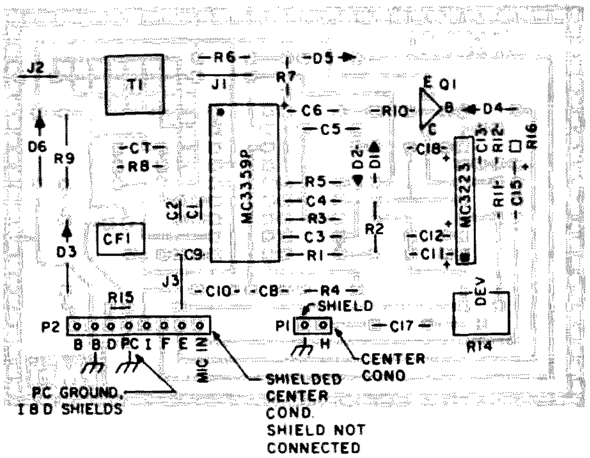


Fig. 11. PC board (component side).

7) Solder cable (audio input to SK3223) to mike gain control. Photo E.

8) Solder wire SQ to RIT board, Fig. 3(F).

9) Solder an rf resistor at the junction of R28, R29, C34, and R30. See schematic, PLL unit; add a 22k resistor to the choke and solder shield to nearest can, solder center of cable to resistor, route the cable and replace shield cover, Fig. 5(H); Photo F.

10) Drill two holes in the chassis at the rf unit compartment (top of unit); be careful with the metal chips—the rig does not like them at all! Cut a piece of cardboard and cover the rf unit. Install the board on top of the rf unit and plug cable to the board. (Holes are not required, but a two-sided tape is recommended to secure the FM board.)

11) Take a break, get a cup of coffee, and relax a bit.

12) Now that you are cooled off and relaxed, let's check the work by starting at the beginning (Step 1). Make sure there are no solder pieces running around, bad connections, or shorts anywhere.

13) Put some tape on the top and bottom covers to prevent the board from shorting to it.

14) Connect the power supply and make sure RIT is off and CCW and speaker are connected. Turn it on and select AM mode. You should hear a hiss at the speaker. Turn RIT squelch CW till speaker goes dead.

15) If you have an rf generator, feed a signal to the antenna input of about 100 FM at 1 kHz with 4-kHz deviation and adjust quad coil for best sound or best 1 kHz on the scope, connected at the speaker. It is a very sharp adjustment. Connect the rig to a dummy load, feed a loud signal to the mike from the CW keyer, and adjust the deviation pot for 5-kHz deviation. If you don't have a meter, adjust the pot to center and get on the air with someone to help you adjust the deviation.

16) One relay is used to preserve AM—do connect the supply voltage to it before any regulator of 730, because it may not regulate properly with the additional current drain.

That's all there is to it. You're all set to explore the fun of 29.5-29.7 MHz. Tune first to 29.6 MHz, the international simplex calling frequency. Next listen for repeater outputs in 10-kHz jumps from 29.61-29.69. Inputs are 100 kHz below output frequencies.

Best DX!

I would like to thank all of you who helped me with this modification article, and a special thanks to the Crystal Lake Repeater Group, AE9F, KN9N, WD9DRC, N9KC, KC9XU, Fred Palmer from ICOM, and N9DP for their direct help in the design.

Notes: To adjust squelch to your taste, lift R5 and change R6 so RIT pot is positioned to your taste (squelch closed); then change R5 to adjust squelch tail; R5 can be as high as 500k. The board can be obtained from the author for $15.00, the tested module and harness for $75.00, or installation of the module in your radio for $110.00 plus shipping cost. All mail and questions will be answered—please send an SASE. ■

Parts List

Component	Value; ID		Source	Unit Price
D1-5	1N914 or 1N4148		RS or Motorola	$ .20
D6	1N4734A		Motorola	1.20
C1, 2, 5, 7	.1 uF (104)	CY20C104M	Centralab	.50
C3, 4, 13	.001 uF (102)	CY15C102M	Centralab	.25
C6	4.7 uF	ECEA1EV4R7S	Panasonic	.25
C8, 10, 17	.01 uF (103)	CY15C103M	Centralab	.25
C9	100 pF	CD15FD101J3	CDE	.35
C11, 12	10 uF	ECEA1EV100S	Panasonic	.50
C15	1 uF	ECEA1HV010S	Panasonic	.70
C18	2.2 uF	ECEA1HV2R2S	Panasonic	.50
All resistors ¼ W, 5%				.20
Rac	150k			
R1	8.2k			
R2	1.5k			
R3	330k			
R4	47k			
R5, 16	200k			
R9	120 Ohms			
R10, ab	10k			
R7	18k			
R8	470k			
R11, 12	1k			
R13	22k			
R14	10k pot (Dev)	EUNK0AA00B14	Panasonic	.30
R15	470 Ohms			
R6	180k			
Q1	2SA1015 or 2N3906 (PNP)			.25
IC1	MC3359P		Motorola	4.00
CF1	CFU455F (filter)		Murata	4.00
IC2	TA7061 or SK3223			4.00
T1	455 Quad coil—RCM-2A6597HM—Toko			2.00
RF1	1-uH rf choke			1.00
S1	Triple-pole single-throw			4.00
P1	2-position right-angle connector amp			1.00
P2	8-position right-angle connector amp			2.50

Harry A. Schools KA3B
1606 S. Newkirk Street
Philadelphia PA 19145

Join the SWOT Team!

2m FM is fun, but using a repeater won't challenge your skill. Turn the switch to SSB and find out what ham radio is really about!

Photo A. Here is the author as DA2AL in the Hunsruck Mountains of West Germany during a Region I VHF Contest, putting a scarce grid square on the air. Although mountaintopping isn't as popular in the US as it is in Europe, it is no longer rare to see American hams heading for the hills.

Even as little as fifteen years ago, 2-meter SSB was basically considered a barren no-man's-land with only a handful of operators occupying the band. Activity was slight, even in heavily-populated areas such as the Northeast, with numerous band openings going unnoticed. However, the status of 2-meter SSB has changed dramatically since then, especially over the last decade.

With the advent of fully-synthesized multimode rigs and affordable power amplifiers, receive preamplifiers, and antennas, 2-meter-SSB capability is readily available at modest cost and is no longer the mode once inhabited almost entirely by the home-brewer and experimenter. Even so, there are many amateurs who underestimate its potential in terms of DX and reliable communication over appreciable distances. For the Technician-class licensee who yearns to work some interesting DX or for the old-timer who has had it with crowded repeaters, 2-meter SSB may be a ticket to fun and enjoyment.

Let me point out that the main intent of this article is basically to inform the reader that there is an abundance of 2-meter SSB/CW activity taking place and to introduce the "Sidewinders On Two" organization, otherwise known as SWOT, which caters to the SSB/CW enthusiast. To fully cover areas such as antennas and radio-wave propagation would be almost impossible, as books have been written on these subjects. Therefore, I will make generalizations which can be researched through further reading.

Getting on the Air

Unlike years gone by, 2-meter multimode transceivers are readily available as either large base-station units with built-in ac power supplies or as smaller base/mobile rigs which require an external dc power supply if they are to be used at the home station. Whatever way you decide to go, remember that the cost of a multimode rig is not much more than that of an FM transceiver.

Two features which now are standard on most of the newer rigs have made life easier for the sidebander: scanning and squelch on

sideband. Besides having the transceiver scan for signals during slow periods, listening to receiver white noise for hours on end is a thing of the past. As for power outputs, most rigs now on the market run anywhere from 10 to 30 Watts, which is sufficient to work DX in most cases.

Transverters. If it is not feasible to purchase a separate multimode rig, then a transverter would be an alternative to get on the band.

If you currently maintain an HF station that was manufactured in the mid 1970s or later, there's a good chance that the manufacturer of the rig has a 2-meter transverter which is compatible. The cost of a transverter, even if it requires modifications for use on your HF rig, is well below that of a separate multimode transceiver.

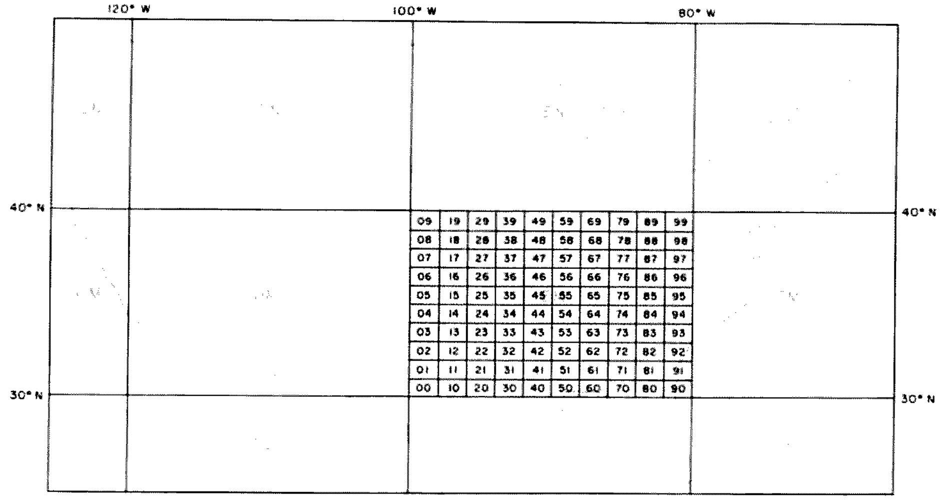


Fig. 1. Shown above is the grid-square layout for the United States under the Maidenhead Locator. Each field is broken down into 100 2° × 1° grid squares measuring approximately 100 × 70 miles in size, and numbered exactly like the Echo Mike field in the diagram. To figure out your own grid-square locator number, refer to the article on page 49 of the January, 1983, QST *or the October, 1982, issue of the* Lunar Letter, *edited by KI7D.*

Antennas

Polarization. Some amateurs who purchase multimode rigs are disappointed when they venture into the low end of 144 MHz in hopes of finding someone to talk to, but hear nothing but receiver white noise instead. Although it is no fault of their own, a common mistake made by newcomers to the band is to start tuning around using a vertically-polarized antenna. Unless they are in a heavily populated area with many stations active on the band, chances are that they will hear absolutely nothing.

On 2-meter SSB, just about everyone is horizontally polarized, and because of this, vertical antennas do not perform well. The cross-polarization loss between a station running vertical and a station running horizontal is debatable. However, most agree that it is in the area of 20 dB. With a loss figure this high, even local stations can sometimes be very weak, with severe fading if two stations are cross-polarized.

Horizontal polarization is preferred because signals that are polarized in this fashion are more consistent over greater distances, with less fading and flutter. Also, since most man-made electrical noise is vertically polarized, a horizontal antenna exhibits a nulling effect which greatly reduces static noise levels.

The yagi. Just as ground planes are used widely for FM work, yagis are the workhorse of the SSB operator. Most operators utilize a single long-boom yagi mounted high enough to clear any serious obstructions. Even if the antenna is 30 feet off the ground, if it's clear of nearby buildings, trees, or power lines, it should work flawlessly. Long-boom yagis are generally 15 to 20 feet in length with forward-gain figures of roughly 12 to 16 dB.

Being relatively small compared to its HF counterparts, the main advantage of the yagi is that it is lightweight; it can be turned easily with a small TV-type antenna rotator. A single yagi will work quite well even with 10 Watts, but usually the more serious operators or EME (moonbounce) enthusiasts stack their yagis in large arrays for greater gain and directivity. Besides the yagi, other antennas which are used on SSB to a lesser extent are collinear arrays and quads.

Omnidirectional antennas. If it is not feasible to erect a beam antenna due to space limitations, then a compromise would be a halo. The halo is an omnidirectional, horizontally-polarized antenna which exhibits less than unity gain. Halos are quite popular with 2-meter-SSB mobile operators because they are relatively small.

Another choice would be the squalo, which is actually a square halo. Back in the 1960s Cushcraft Corporation manufactured a squalo, and at times they can still be found at hamfests and electronics flea markets.

Probably the best horizontally-polarized omnidirectional antenna that one could use would be the Big Wheel. As with the squalo, the Big Wheel was manufactured by Cushcraft back in the 1960s. It was very popular due to the fact that it was rated at 3-dB gain, making it that much better than the unity-gain halo and squalo. Also, Big Wheels could be stacked for even greater gain, making them that much more desirable for those who cannot erect beams. Shaped like a three-leaf clover, Big Wheel construction articles are quite common in VHF antenna books under names like the cloverleaf and the turnstile.

Power

As noted before, 10 to 30 Watts is an adequate power level for working most types of DX on 2 meters. However, when it comes to attempting contacts on meteor scatter or aurora, a higher output power will prove beneficial. I don't mean to imply that it can't be done with 10 Watts . . . it can! But due to the nature of these propagation modes, a higher power level is required for optimum results. Most newcomers to the band soon find out that the average station runs somewhere in the area of 80 to 170 Watts. And just like the HF bands, 2 meters has its share of those who run the full legal limit, especially where moonbounce is concerned.

Amps and Preamps

As with multimode rigs, there is a wide variety of solid-state amplifiers avail-

Photo B. *The use of transverters such as the FTV-901R, which is compatible with the Yaesu 901 series, is a cost-effective way of getting on 2-meter SSB.*

Photo C. *Multiband, multimode capability is available in the VHF/UHF gear that is now available. Besides 2-meter operation, the Yaesu FT-726R is also operational on 6 meters and 70 cm through the use of plug-in modules. (Photo courtesy of Yaesu.)*

able on the market. Most of these amplifiers require anywhere from 1 to 30 Watts of drive and will deliver anywhere from 80 to 160 Watts, depending on the model. Besides being switchable for SSB or FM use, most of these amps are also supplied with receiving preamplifiers which greatly improve the signal-to-noise ratio of the received signal. For those operators who desire even higher output, there are many amplifier kits available for the home-brewer, and to a lesser degree commercially available units which will provide a solid kW.

Contrary to popular belief, most of the rigs today do not have hot receivers. Anyone who has been involved with the band for any length of time will tell you that the addition of a receive preamplifier is a must. For communications within a few hundred miles, a stock receiver may work just fine, but for weak-signal work or during marginal band openings, most rigs can't cut the mustard. The addition of a receive preamplifier can make the difference between getting a Q5 copy on a signal or not hearing it at all.

Preamplifiers can be purchased as small circuit boards which can be internally mounted to your existing transceiver, as separate enclosed units with BNC or SO-239 connectors for quick and easy installation, or as the highly sensitive mast-mounted GaAsFETs.

Propagation

Radio-wave propagation on 2 meters falls basically into two categories, these being tropospheric and ionospheric. The troposphere is a region which extends from the ground up to about eight miles. It is here that most VHF propagation takes place and also where our weather is formed. Because of this, 2-meter signals are greatly affected by temperature, water vapor, pressure, and, in general, the movement of air masses and weather systems. Two types of tropospheric propagation that occur quite frequently are: thermal inversions which can extend signals beyond 500 miles, and tropospheric ducting which has the ability to carry signals in excess of 2000 miles.

Temperature inversions. Also known as thermal inversions, this mode of propagation is most common to the 2-meter band. Temperature inversions are formed when there is a reversal of the atmosphere's height-to-temperature relationship, which in turn affects its refractive index. Under normal atmospheric conditions, there is a temperature decrease with ascending altitude. However, there are times when the temperature at some point stabilizes or even rises with increased height when a layer of warm air is trapped between two layers of cooler air. This warm air constitutes a thermal inversion and with it, the refractive index is increased.

Inversions can propagate VHF and UHF signals up to three times the normal range and, depending on their intensity, signals will be either weak with some flutter or rock solid with very little fading. This phenomenon is prevalent along coastal areas, especially in the spring and fall. This is the result of a greater temperature difference between land and water. Although inversions are primarily a nighttime effect, smaller inversions often occur just after dawn and after sunset, when some enhancement of the signal can usually be noticed.

Tropospheric ducting. The causes of tropospheric ducting cannot be explained easily, but most scientists and propagation experts seem to agree that they are the product of wind shears, which are high velocity winds that are blowing in opposite directions to each other. The boundary area between these winds has the ability to propagate VHF and UHF signals thousands of miles. Ducts can be very selective to various geographical areas, with other stations at points in between not being aware of its existence. In other words, if a duct were to form between New England and Texas, stations in places such as Tennessee and Kentucky, which are along the duct's path, may not necessarily be able to take part in the opening.

Ducting can continue anywhere from a few minutes to a few days. It is this propagation mode which has made possible QSOs between stations in Hawaii and California, which is a distance of approximately 2500 miles.

Ionospheric propagation. Sporadic E, aurora, meteor scatter, and transequatorial propagation (otherwise known as TE) are propagation modes that fall into the ionospheric or solar-related category.

Sporadic E. Sporadic E gets its name from heavily ionized clouds that form in the E-region of the ionosphere, which is about 60 miles above the earth. It is rare for these clouds to reflect 144-MHz signals, but when they do, E-skip contacts can be made up to approximately 1200 miles. The formation of these E-clouds is the result of wind shears and, to a cer-

tain extent, intense thunderstorm activity, which produces very high cloud tops.

Excellent indicators for a possible E-skip opening on 2 meters are TV channels 4, 5, 6, and especially the FM broadcast band, which ranges from 88 to 108 MHz. Also, when skip conditions become extremely short on 6 or 10 meters to within a few hundred miles, it is a good idea to begin looking on the band for something to happen.

Although E-skip can occur at any time, seasonal peaks do take place from June through August and again during December and January. Openings can last anywhere from a few minutes to a few hours, but since E-clouds are moving at a high rate of speed and their ionization density is critical for supporting 144-MHz signals, conditions change very rapidly.

Finally, double-hop E-skip is rarer still, but it has been done, with contacts made in excess of 2000 miles.

Aurora. Intense ionization of the polar regions following disturbed periods on the sun allows amateurs to reflect their signals off heavily ionized patches or auroral curtains. Curtains are formed when solar disturbances emit particles which arrive at Earth a few days after the storm is first observed. These particles then congregate at the polar regions and form what is known as an aurora.

Since the aurora is a culmination of numerous patches of intense ionization which are in constant motion, VHF and sometimes UHF signals are reflected back in different phases. This multi-path reception or phase difference causes the received SSB signal to have a whispery or sometimes garbled effect and CW signals to sound like a hiss instead of a pure note.

Auroras are common during the winter and summer equinoctial periods, with peaks generally taking place from 4:00 pm to 8:00 pm local time. For obvious reasons, the mid- and high-latitude states experience many auroral openings per year, but from time to time its effects can be felt as far south as the Gulf states. Contacts are normally on the order of 800 miles, although some of over 1200 miles have taken place.

Auroral contacts. By pointing the antenna towards the north a few days after a solar disturbance, auroral contacts are possible. Normally, CW signals are the only ones to be heard, but if the aurora is intense enough, SSB can be copied with signals sometimes well over S9.

When calling CQ on CW it is customary to send "CQ A" or "CQ AU." On sideband, the call is simply "CQ Aurora." One important thing to remember is that since SSB is received as whispers or even garbles, it is imperative that one speak slowly, using phonetics and trying to enunciate words properly. Unless conditions are near perfect, E's, T's, C's, D's, etc., sound an awful lot alike. With pure notes not being received on CW, reports are given as 59A instead of 599.

Since the aurora is in constant motion, signal strength will vary from time to time during the course of a QSO. Therefore, it is sometimes necessary to peak for maximum signal by moving the antenna a few degrees either way. At times, a movement of 10 degrees can make the difference between Q5 copy and not hearing the station at all.

Meteor scatter. As mentioned before, sporadic-E and auroral propagation are possible through the direct result of intense ionization. This holds true with meteor scatter also. Meteors which enter the Earth's atmosphere burn up, leaving trails of ionization which at times have the ability to reflect radio waves, permitting contacts in excess of 1500 miles. The length of time that an ionization trail remains intact and intense enough to support 2-meter signals is dependent upon the size of the meteor and its orientation to the amateur station. Most meteor bursts (or *pings*) last a few seconds, with a rare few exceeding 15 seconds. Thus, high-speed CW is the preferred mode although SSB is being used more and more.

Meteor-scatter DXing. With most contacts being arranged through predetermined schedules with other stations, attempting to work meteor-scatter DX requires patience and perseverance. Since working through random meteors is time consuming, almost all contacts are attempted during major meteor showers such as the Perseids in late July and early August, where the hourly rate of meteors entering the atmosphere is very high.

The operating procedures for working meteor-scatter DX are too extensive to list here. However, the basic format is for one station to transmit during the first and third quarter of each minute while the other station transmits on the alternate 15-second periods. It may go on like this for hours until both stations acknowledge callsigns and signal reports. Most important, though, is that phrases such as "this is" and "your signal is" be eliminated, as most bursts are relatively short. As far as output power is concerned, 80 Watts is sufficient for making contacts without too much trouble. Surprisingly, many amateurs have made successful QSOs with as little as 10 Watts.

Transequatorial propagation. Transequatorial propagation (or TE) has been evident on the 6-meter band for some time, but just recently over the last decade has its presence been felt on 2 meters. TE takes place in the F2

144.000-144.050 MHz	EME (Moonbounce) CW
144.050-144.060 MHz	Beacons
144.060-144.100 MHz	General CW and weak signals
144.100-144.200 MHz	EME (Moonbounce) and weak-signal SSB
144.200 MHz	National calling frequency
144.200-144.300 MHz	General SSB operation

Note: Upper sideband (USB) mode is used.

Table 4. 144-MHz SSB/CW band plan.

Year	Tropo	E-Skip
1976	4	2
1977	10	6
1978	5	1
1979	6	6
1980	5	2
1981	8	7
1982	7	11
Total	45	35

Table 1. Annual breakdown of observed band openings into the Fort Worth, Texas, area over a seven-year period.

Month	Tropo	E-Skip
Jan	0	1
Feb	1	0
Mar	1	0
Apr	3	0
May	5	0
Jun	21	11
Jul	0	10
Aug	7	9
Sep	2	4
Oct	3	0
Nov	0	0
Dec	3	1

Table 2. Monthly breakdown of observed band openings into the Fort Worth, Texas, area over a seven-year period.

Season	Tropo	E-Skip
Summer	9	23
Fall	6	1
Winter	2	1
Spring	29	11

Table 3. Seasonal breakdown of observed band openings into the Fort Worth, Texas, area over a seven-year period.

region of the ionosphere and, as far as it is known, is accessible to stations centered at equal distances on both sides of the geomagnetic equator. For example, contacts of close to 5000 miles have been made between Europe and South Africa and between Puerto Rico and Argentina.

DX: What to Expect

As with any phenomenon, the mechanisms which facilitate VHF DX are at times unpredictable. Although there are exceptions to almost every rule of propagation, long-term statistical analysis of band openings does prove certain things.

Len Hoops KC5IJ provided me with a computerized list of band openings into the Fort Worth, Texas, area over a seven-year period from 1976 to 1982. Once I categorized these openings according to year, month, and season, it was evident that everything I had ever read concerning VHF propagation was basically true. The numbers didn't lie.

Keep in mind that some parts of the country experience more band openings, especially where tropo is concerned. As mentioned earlier, this is due to geographical location (tropo is more prevalent along coastal areas). Despite this, the numbers are still indicative of seasonal peaks.

Looking at the annual breakdown of observed band openings, it is interesting to note that the number of tropo-DX openings was about the same each year, whereas E-skip DX varied quite a bit. On the average, KC5IJ experienced 6 tropo and 5 E-skip openings per year. (See Table 1.)

The monthly breakdown shows that June is by far the most active month in terms of DX. This is true just about everywhere. Spring and fall show an increase in tropo DX which was noted earlier, and the summer months clearly reveal that this time of year is the best for working E-skip. (See Table 2.)

SSB/CW Band Plan

Table 4 shows the band plan for the low end of 144 MHz. For the most part, this particular plan has gained acceptance and is adhered to on a nationwide basis. As you can see, 144.200 MHz is the national calling frequency, and most of the activity is centered here.

Making Contact

On SSB it is perfectly all right to call CQ just as you would on the HF bands. As a matter of fact, this is standard operating procedure. When calling CQ, it is generally a good idea to give your callsign phonetically, your location, and in which direction you are beaming (if a directional antenna is being used). If a vertical antenna is being utilized, say so during your CQ. This will be very helpful because almost everyone is horizontally polarized and the subsequent cross-polarization loss is around 20 dB. That weak signal that one may think is DX can sometimes be a station 10 miles away on a ground plane.

Once contact is established with another station, a move up in frequency to 144.210, 144.220, 144.230, etc., is recommended. Ragchewing on or very near the calling frequency is frowned upon, so it's best to QSY once contact is made. As for CW buffs, it is OK to call CQ on CW on 144.200 MHz. But once again, it is recommended to QSY once contact is made.

Activity

When it comes to the level of activity on 2-meter SSB, it is no different than

Day	UTC	Time	Area	Name	Freq.	NCS
ALL	LOCAL	TIME	IS IN	STANDARD	TIME	EFF. OCT. 27, 85
Sun	1500Z	10:00 AM	NYC	East Coast	144.250	WA2SLY/WA2FXB/WA2PJZ
Sun	0415Z	8:15 PM	Nevada	NV Activity	144.225	WA7JUO
Sun	1530Z	8:30 AM	Tucson	Arizona-Tucson	144.300	N7WS/W5DXN
Sun	0300Z	8:00 PM	Orlando	Sunshine State	144.250	WA4GPF WD4FAB KA4WWL
Sun	0200Z	8:00 PM	Arkansas	Razorback	144.250	NR5A, WB5JAR, WB5PNZ
Sun	0300Z	9:00 PM	Twin Cities	Minnesota	144.250	W0KRX
Sun	0330Z	7:30 PM	So. Calif.	SOCAL	144.250	WB6NOA/KF6ZB/K6PVS
Mon	0230Z	8:30 PM	INDIANA	SE Indiana	144.250	KABMRI
Mon	0300Z	9:00 PM	So. Tex.	So. Texas	144.250	KD5CB NB5O
Mon	0400Z	8:00 PM	Spokane	Inland Empire	144.250	KB7N
Mon	0400Z	9:00 PM	Salt Lake	Mtn. States	144.250	N7BHC
Tue	0230Z	9:30 PM	Greensboro	N. C. SWOT	144.250	KA1LMN/4
Tue	0300Z	9:00 PM	Rio Grande	Republic of Rio G	144.250	N5DQD/WB5YVD
Tue		9:00 PM	Anchorage	Alaska	144.200	KL7JAI/KL7IKV/KL7QS/
Tue	0230Z	8:30 PM	So. Ill.	"Little Egypt"	144.250	N5AFL/KA9HDZ
Tue	0300Z	8:00 PM	Phoenix	Arizona-Phoenix	144.300	KB7CH
Tue	0400Z	8:00 PM	North Count	NORCAL	144.250	WA6ZJF
Wed	0100Z	8:00 PM	Cleveland	N. Central States	144.255	KBRAQ/WD8PKQ/W8FQK
Wed.	0200Z	9:00 PM	East PA	Delaware Valley	144.250	WB2BJH/WA2ADS/N3BHS
Wed	0300Z	9:00 PM	IA/MO/IL	Tri-State	144.250	WB0SWD/WB9WMM/N9CXO
Wed	0300Z	9:00 PM	N. Texas	Hdqrtrs	144.250	WD5DJT KA5NGG
Thu	0200Z	8:00 PM	Chicago	INDY	144.250	KA9EJJ/KA(MXF
Thu	0200Z	9:00 PM	West VA	Triple-States	144.150	WB8ZTV/KJ8J
Thu	0400Z	8:00 PM	South Count	NORCAL	144.250	N6EIO, K9TGT, K6HXW,
Sat	1300Z	7:00 AM	North Texas	Hdqrtrs	144.250	WA5DBY/K5ASZ
Sat	1600Z	8:00 AM	WA-ID-MT	Inland Empire	144.110	W7HAH/N7ART
Tue	0145Z	8:45 PM	MD to OH	Activity group	144.170	W3WN
Fri	0145Z	8:45 PM	MD to OH	Activity Group	144.170	W3WN
Sun	0145Z	8:45 PM	MD to OH	Activity Group	144.170	W3WN

Table 5. SWOT nets currently active.

	Antennas	
Cushcraft Corporation PO Box 4680 Manchester NH 03108	KLM PO Box 816 Morgan Hill CA 95037	Austin Custom Antennas RFD #1, Tenney Road Sandown NH 03873
Jaybeams from: JASCO International PO Box 29184 Lincoln NE 68529		F9FT (Tonna from France) by: N&G Distributing Corporation 7201 NW 12th St. Miami FL 33126
	Amplifiers	
V-J Products, Inc. 505 E. Shaw Pasadena TX 77506	Henry Radio 2050 S. Bundy Drive Los Angeles CA 90025	Communications Concepts 2648 N. Aragon Ave. Dayton OH 45420
Daiwa USA, Inc. 1908A Del Amo Blvd. Torrance Ca 90501	TE Systems PO Box 25845 Los Angeles CA 90025	Mirage Communication Equipment PO Box 1000 Morgan Hill CA 95037
Arcos (kits) Harold Bramstedt 6104 Egg Lake Road Hugo MN 55038		Tokyo Hi-Power Labs by: ENCOMM Inc. 2000 Avenue G, Suite 800 Plano TX 75074
	Preamps	
Janel Laboratories 33890 Eastgate Cir. Corvallis OR 97333	Advanced Receiver Research PO Box 1242 Burlington CT 06013	
Radiokit PO Box 4115 Greenville NH 03048	Hamtronics, Inc. 65 Moul Road Hilton NY 14468	

Table 6. Some of the major manufacturers of 2-meter SSB equipment. Brochures and catalogs are available upon request.

any other ham band—it has its up and down periods. Generally speaking, 90% of all activity occurs between 6:00 pm and midnight local time, and to a lesser degree from 8:00 am to 11:00 am local time. But don't be fooled! Unfortunately, many operators leave their rigs sitting on 144.200 MHz and listen to white noise when the band may be open. Whether it's three in the morning or three in the afternoon, one cannot assume that the band is dead. You have to make calls to get results.

In addition to the SWOT nets listed in Table 5, there are many localized VHF clubs which sponsor activity nights with nets open to all amateurs. One of the nicer things about the SSB portion of the band is that there is an even mix between rag-chewers, VHF DXers, experimenters, home-brewers, and the like. It is basically a band of moderate activity with plenty of elbow room for everyone. Splatter and QRM are almost nonexistent except for the busy periods of VHF contests, when everyone seems to come out of the woodwork. And when the band cooperates with a good E-skip or tropo opening, 2 meters sounds much like 20 meters, minus the foreign DX of course.

Referring to the seasonal breakdown, it is evident that spring is the best season for DX. Although the numbers of band openings for fall and winter are much lower, they do prove that tropo and E-skip can occur at any time. (See Table 3.)

Over this seven-year period, KC5IJ worked 32 states via E-skip and 20 states via tropo for a total of 35 different states worked. His equipment varied over the years, but generally speaking he ran about 200 Watts of power with antennas that included an F9FT yagi and a 20-element collinear array.

Normal Range

The normal range of 2-meter SSB and CW depends upon many factors such as terrain, antenna height, antenna gain, power, etc. However, most will find that their range under normal band conditions is on the order of 150 to 200 miles. DX contacts are usually referred to as those exceeding 500 miles.

Propagation Beacons

As is the case with 6 meters and 10 meters, beacons are operational to assist amateurs in determining band conditions and to aid the beacon's operators in the study of radio-wave propagation, which is dependent on listeners' reports. There are currently three operational beacons in the US, with more in the planning stages. Amateurs are encouraged to monitor the beacon frequencies from 144.050 MHz to 144.060 MHz and to submit reception reports which will in turn allow propagation phenomena to be better understood.

The W3VD beacon. The W3VD beacon is operational 24 hours a day on 144.052 MHz. The beacon, which is located between Baltimore, Maryland, and Washington, DC, in grid square FM 19, runs 25 Watts to a halo antenna at 30 feet. W3VD is operated by Johns Hopkins University's Applied Physics Laboratory in Laurel, Maryland.

The WB2IEY beacon. Sponsored by Tom Richmond WB2IEY and the Rochester, New York, VHF Group, this beacon is also operational 24 hours a day on 144.051 MHz. Located in Naples, New York, in grid square FN 12, the beacon runs 3 Watts to a pair of Big Wheels.

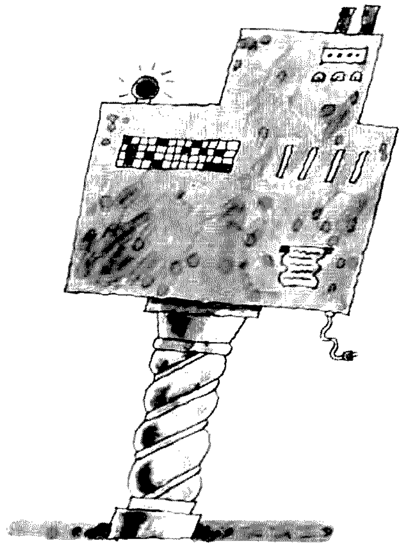
The WB2RJL beacon. The WB2RJL beacon has been in operation since August, 1984. It is a 24-hour-a-day beacon on 144.055 MHz. The beacon is located in downtown Winter Park, Florida, a suburb of Orlando, in grid square EL 98, and runs 20 Watts to a pair of stacked Big Wheels. Reception reports can be sent to Chris Johnson WB2RJL.

Sidewinders On Two

In 1976, the need for an organization to promote 2-meter activity on SSB and CW became evident, much like the SMIRK organization for 6 meters and 10-10 International for 10 meters. Two-meter FM repeaters were threatening to encroach upon areas that were being used by SSB operators. The frequency used back then was 145.100 MHz, and a new section above this frequency was being authorized for more repeaters. The opening of the band below 145 MHz to 144 MHz to Technician-class licensees caused the national calling frequency to be moved from 145.100 to 144.200 MHz. Prior to this, only higher-grade licensees were allowed to work in the area around 144.100 being used for DX work on SSB and CW.

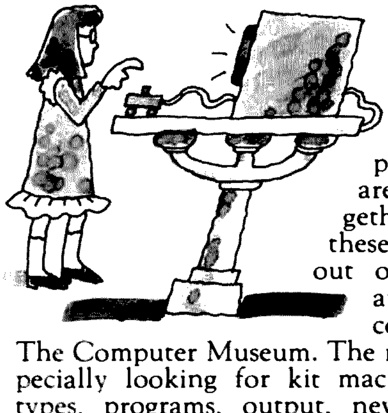
The SWOT organization was formed March 28, 1976, by four Fort Worth, Texas, amateurs: K5ASZ, WB5MEV (now KB5SV), W5ARR, and W5JTA (now KC5IJ). The charter members signing at this time were given num-

WANTED: OLD THINKER TOYS.

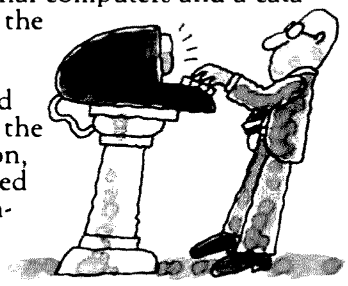


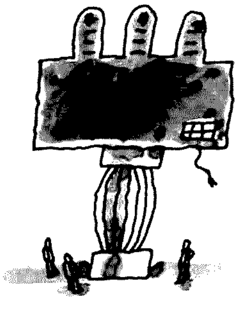
CW Communications, ComputerLand and The Computer Museum invite you to send in your early personal computers, software, and memorabilia — you could win a free trip to The Computer Museum in Boston

Your old, dusty "thinker toy" may now be ready to become a treasured museum piece. The Computer Museum in downtown Boston — an international museum dedicated entirely to computing — is searching for the very best and most unique relics of the personal computer revolution.



ComputerLand, CW Communications, and The Computer Museum are working together to bring these early relics out of your attic and into the collection of The Computer Museum. The museum is especially looking for kit machines, prototypes, programs, output, newsletters and memorabilia of early computing from around the world. A selection of the finest items will be used to create an exhibit on the evolution of personal computers and a catalog highlighting the Museum's collections. If your submission is accepted for addition to the Museum collection, you will be invited to the grand opening of the exhibit and will receive a bound edition of the catalog. If your item is selected as one of the five best "finds", you will also receive an all-expense-paid trip to Boston for the grand opening party.





So, get up to the attic, down to the cellar and into your closets, and tell us what you find! Call or write the Museum for an official entry form, or send a photo and description of your items by March 1, 1986 to: The Computer Museum, Personal Computer Competition, 300 Congress St., Museum Wharf, Boston, Massachusetts USA 02110, (617) 426-2800, Telex: 62792318.

ComputerLand®

The Computer Museum

CW COMMUNICATIONS/INC.

Entries will be judged on significance, rarity, date, completness and condition. Items particularly sought include pre-1980 machines, early serial numbers (get those number 1's out), machines made for purchase outside of North America (even modern machines are sought in this category); first releases of software such as first releases of operating systems, languages and mass-marketed and original applications; and pre-1980 photographs, newsletters, manuals and other records. The Computer Museum is a private non-profit educational institution. All donations are tax-deductible according to the provisions of the Internal Revenue Service. Thinker Toys is a registered trademark of George Murrow & Murrow Designs, Inc.

bers 1 through 26, with lots cast by the organizing committee for the first four numbers. W5ARR was to be chairman, WB5MEV treasurer, K5ASZ net manager, and W5JTA secretary. W5JTA also started a newsletter called the *SWOT Bulletin*; the first issue appeared in April, 1976, and it has been published at least 10 times a year ever since.

The purpose of the club was to promote 2-meter SSB and CW with an emphasis on a study of DX propagation. DX has thus become the leading interest of the members. Nets were organized starting with the Fort Worth area managed by K5ASZ, and W5JTA (KC5IJ) extended the nets nationwide. SWOT now has nets coast to coast, some with only a few members and others with as many as 50 check-ins per meeting. (See Table 5.)

Membership in the SWOT organization is open to any 2-meter operator authorized to use the band. Those who have worked two SWOT members become full members, while others may also join and become full members upon furnishing the callsigns and SWOT numbers of two members worked. Application forms appear in each issue of the *SWOT Bulletin*, although this form is not required.

The dues are $5.00 without the *Bulletin* and $10.00 with it. Renewals are the same except that family members, where extra membership lists are not needed, will be $5.00. Applications can be sent to Howard Hallman WD5DJT, 3230 Springfield, Lancaster TX 75134. The current membership in SWOT is over 2700—with Canada, Bermuda, Europe, and all of the USA represented.

The *SWOT Bulletin*, which is now edited by Harry A. Arsenault K1PLR, 704 Curtiss Drive, Garner NC 27529, is a very informative publication that the SSB/CW enthusiast shouldn't do without. The *Bulletin* includes membership activity reports, net updates, construction articles, swap and sell items, new member listings, beacon information, upcoming contests, VHF/UHF conference information, schedule requests for meteor-scatter operators, and from time to time some very interesting propagation notes written by Emil Pocock W3EP.

A certificate for working 10 or more SWOT members is available. Fifteen more contacts gets a "Worked 25" seal and other endorsements are made in steps of 25. Some members have qualified for over 350 SWOT members worked.

Each year a contest is set up for working other SSB/CW stations, the rules of which are published ahead of time in the major ham-radio magazines. Jerome Doerrie K5IS of Booker, Texas, is the awards and contests manager.

Grid Squares

In order to stimulate activity on the VHF and UHF bands, some years back Europeans devised a *QTH Kenner System*, whereby the continent was divided up into grids which were determined by longitude and latitude. With each grid and specific geographical location within the grid having its own alphanumeric designators, the exact location of a station could be determined. In time, collecting different grid squares became a popular competition on the bands.

Unfortunately, the numbering scheme utilized in this particular system could not be adopted for worldwide use. However, the *Maidenhead Locator* system has solved this problem.

The first area defined by the Maidenhead system is the 20° × 10° *field* which is designated by two letters. This field is then broken down into 100 2° × 1° *grid squares* which measure approximately 100 × 70 miles in size and are indicated by two numbers. To indicate location more precisely, two additional letters are used to indicate the 5′ × 2.5′ *subsquare* which is roughly 4 × 3 miles in area.

For example, the full locator number for my QTH in South Philadelphia is FM 29 JW. For on-the-air exchanges, it is general practice to give only the first four characters, or in my case FM 29.

On January 1, 1983, the ARRL introduced an awards program called the VHF/UHF Century Club Award (or VUCC) which involves the Maidenhead Locator. For 2-meter operators, it is required to confirm 100 different grid squares to qualify for the award. (See Fig. 1.)

Mountaintopping

Except for contest weekends, mountaintopping hasn't really caught fire here in the United States as it has in Europe. Heading to the hills to put new grid squares on the air is commonplace amongst the VHFers abroad. It is hoped that more Americans will start heading for the hills, too.

Contests

There are four major VHF contests sponsored by the ARRL that generate heavy activity on the SSB and CW portions of 2 meters. These are the VHF Sweepstakes in January, the June VHF QSO Party, the September VHF QSO Party, and the 2-Meter Spring Sprint which was held for the first time in April of 1983. With many stations heading to hills and mountaintops for that extra edge, contests are the perfect time to go hunting for those needed states, counties, grid squares, etc. Rarely does a contest go by without some sort of opening taking place which turns the band into a frenzy that is unlike anything you've ever heard.

Suggested Reading

As noted earlier, my main intention was to inform the reader that there is activity on the SSB and CW portions of 2 meters and to introduce the Sidewinders On Two organization. It was not my plan to delve into the technical aspects of equipment, antennas, and propagation, but instead to give a very brief overview on these subjects. I hope I have succeeded. As for further reading and research, there are many excellent books on the market that the 2-meter enthusiast shouldn't do without.

A few of these are the *VHF Handbook for Radio Amateurs* by W9EGQ and W6SAI, the ARRL *Radio Amateur's Handbook*, the ARRL *Operating Manual*, and the Radio Society of Great Britain *VHF/UHF Operating Manual* by G3RPE and G6JP.

One Final Note

Two-meter SSB is regarded by some as uninteresting or even boring. True, it is not for everyone. But sooner or later the patience and perseverance of those who frequent the band pay off with tremendous band openings which make it seem all worthwhile. There is no comparing the elation of working VHF DX to DXing on the HF bands, as the propagation on HF is just too predictable.

Just ask any 2-meter SSB convert. It is much more satisfying to crack the pileup for the South Dakota station on 1000-mile E-skip than it is to work that HV on twenty. If you don't work the HV from the Vatican, he may be back again tomorrow. But if you don't work the South Dakota station on 2-meter E-skip... well, you get the picture! ■

Gary Sargent WB8TPD
4227 Willow Run Drive
Dayton OH 45430

One-Chip Facsimile

We all talk about the weather; now you can see it on your Atari. You'll be amazed at how simple it is.

Have you ever been tuning the shortwave bands and encountered the distinctive "screech screech" sound of a facsimile signal and wondered what type of information was being transmitted? Very interesting weather charts and satellite photographs are transmitted by various services continuously. These charts will allow you to answer pertinent questions such as: Will it snow on Kamchatka today?, Is the Gulf Stream changing its path?, or Should I take my umbrella to work tomorrow?

If you happen to have an Atari computer system available, using the circuit and computer program described here you will be able to receive and display these facsimile signals. The received charts are displayed on the computer's monitor or TV screen and are roughly two displays wide and three displays long. A joystick is used to scroll the screen around the chart.

The components of this system are: a good-quality communications receiver with SSB capability, a simple tone-detector circuit, an Atari 800 computer system, and the computer program, VISIFAX.

Capabilities

This system will properly display facsimile signals sent at a rate of 120 or 60 lines per minute (LPM). These rates (particularly 120 LPM) are used by most commonly heard stations.

The computer samples each received line a nominal 480 times and can display 512 lines horizontally. While this resolution can give good results, it is less than 50% of the resolution transmitted. Also, gray tones are not used. Thus this system is more suitable for high-contrast, large-format weather charts than for satellite pictures and similar charts with much fine detail.

Figs. 2 through 4 are samples of charts that I have received at my location and are representative of the system's capabilities.

Receiver Requirements

The receiver that you use should be a stable, good-quality general-coverage receiver with SSB capability. If your receiver provides acceptable ease of tuning and frequency stability for SSB voice signals, it should be usable for facsimile reception. I have used a Yaesu FRG-7 and a Sony ICF6500W with good results.

The Tone Detector

The tone detector is a simple circuit that connects between the receiver audio output and joystick port 2 of the computer. The detector converts the facsimile tones to TTL pulses that the computer can use. The circuit is shown in Fig. 1.

The circuit is based on the XR2211 integrated circuit used as a tone detector. R1 and C1 determine the detector's frequency, and R2 is used to adjust for the sharpest detail as a chart is being received. The LED serves as a simple but effective tuning indicator. The circuit requires only 5 volts of power, which is taken from the computer.

The parts may all be obtained from local outlets. The construction methods used are not critical. I eventually added a few components to allow me to use the same basic circuit for CW reception.

The Computer System

The Atari 800 computer and the VISIFAX program are the heart of the system and control all aspects of reading and displaying facsimile charts. The program is written entirely in assembly language and is not shown here because of its length (about 30 pages). It is a complex program that uses several of the Atari's sophisticated capabilities to do the job at hand. The computer is required to have 48K of RAM because of the size of

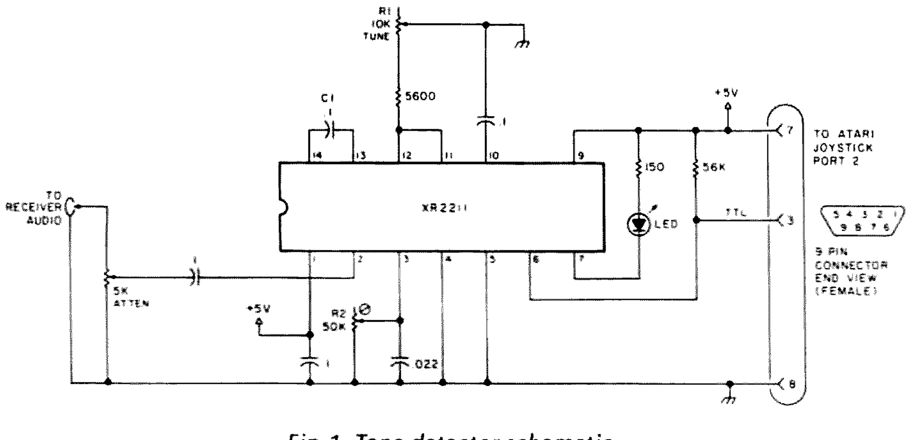


Fig. 1. Tone-detector schematic.

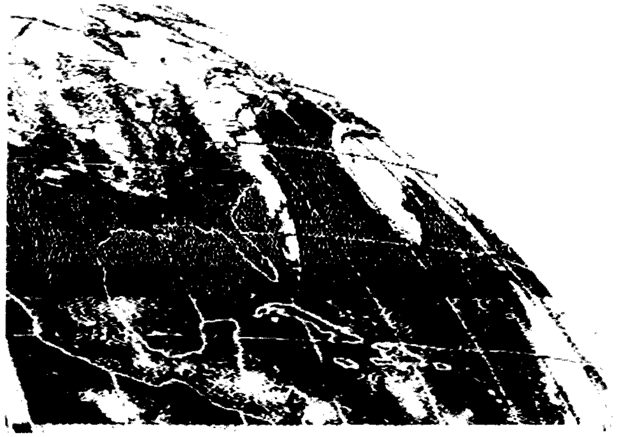


Fig. 2. GOES satellite picture as copied on 8080 kHz. Major cloud cover areas and fronts are readily observed.

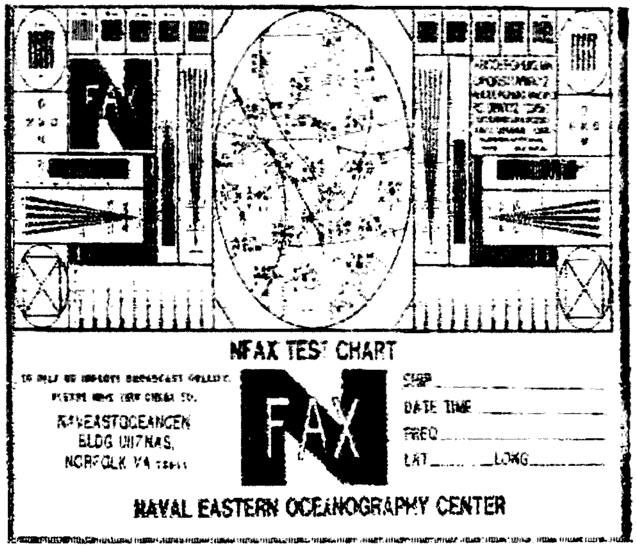


Fig. 3. Test chart copied from NAM on 8080 kHz. A good example of the resolution capabilities of this system.

the chart. A disk is required only to load in the program. An optional printer may be used to produce a hard copy of the received chart and was used to produce the charts that accompany this article.

VISIFAX At Work

VISIFAX begins by initializing for operation, which includes setting up the Atari's hardware timer #4 to interrupt to sample line data and plot it 480 times per line or 960 times per second.

Next, the program will check the joystick plugged into port one of the computer to see if the displayed chart is to be scrolled on the screen. The scrolling effect is accomplished by manipulating the computer's display list.

Finally, the program checks to see if a keyboard key has been pressed. If so, its corresponding command is performed.

The computer screen includes two lines of text at the bottom. These two lines display the available commands and certain status information. To invoke a particular command, only its first letter must be pressed. Any command may be used at any time. The commands are:

RESET: An R will start the process of displaying a chart. The chart is displayed as received from left to right and from the bottom to the top (so most charts are viewed normally...without your having to stand on your head!). Pressing the R again will reset the displayed chart to the left of the screen without altering the synchronization.

SYNC: An S will have the effect of displaying subsequent received lines down the display about one-half inch. This command should be used as required to properly center the received chart. Most stations precede charts with a short period of synchronizing lines that may be used for centering.

LINE-SKIP: An L will increment the number of received lines to skip between displayed lines. This feature will allow compressing of the received chart horizontally, fitting more of it onto the computer's screen. I find that a LINE-SKIP count of 1 is used most often.

MODE: An M will step through the three possible modes of operation. The present mode is shown on the screen's bottom line. Mode "one" indicates that the chart will be received and the process will complete when the right-most line is displayed. Mode "cont" allows the continuous display of charts, with one overlapping the last. Mode "wait" halts the display of any more received lines but does maintain synchronization. This feature may be useful to eliminate unwanted sections of a known chart.

PRINT: A P may be used to print a copy of the present chart on a Gemini 10X printer. The eight-by-eight-inch chart will require about three minutes to print. To abort the printing process, enter another P.

LPM: A 1 or 2 may be entered to select the desired received LPM rate. A 1 will select one line per second (60 LPM), while a 2 will select two lines per second (120 LPM).

Finally, the right portion of the bottom line of the screen indicates the present number of rows (or pixels per received line) and the amount of time between samples, both shown as hexadecimal numbers. The <, >, +, or − keys may be used to increment or decrement these values. This may be required to fine tune your computer to synchronize with the received chart.

How To Use the System

Before starting up your computer, make sure all cartridges are removed. If you have an 800XL computer, hold down the OPTION button while powering on to make sure that Basic is out of the way. 800XL owners will also have to load in the TRANSLATOR disk before loading in VISIFAX. After booting, use Atari DOS option L to load and start your copy of VISIFAX.

Fire up your receiver and then connect its audio output to the tone detector's input and the tone detector's output to joystick port 2 on the computer. Tune in a strong facsimile signal until its characteristic "screech screech" sound is of a medium pitch. Then adjust the detector's TUNE control until the tuning LED blinks in time with the audio.

Press R on the keyboard to start displaying the chart. Use the S and R keys as required to properly position the chart vertically on the display. Fine tune to get the sharpest picture.

Except when printing a chart, the joystick may be used at all times to scroll the received chart around the display.

Where To Tune

By far the best facsimile signals at my location are from the Naval Eastern Oceanography Center (NAM) on 3357, 8080, 10,865, 16,410, and 20,225 kHz. Weather charts and satellite photographs of all types are

broadcast nearly continuously.

Canadian station CFH out of Halifax, Nova Scotia, on 4217, 6330, 10,536, and 13,520 kHz also puts out good facsimile signals. CFH usually broadcasts one or two charts for the first 15 to 30 minutes of each hour.

I have also heard and printed charts from a number of other stations. Try 7640, 7670, 9400, 10,400, 12,125, 14,435, 14,5[illegible], 14,610, and 14,737 kHz.

Where To From Here

Several improvements to VISIFAX jump to mind. A nice feature would be saving and restoring charts from disk. Sometimes a chart is received without proper synchronization, resulting in a chart that is split horizontally, vertically, or both. An option could be provided that would allow manipulating a received chart to straighten out the chart. A more sophisticated tone detector and program changes could result in improved charts. There is a lot of room for experimentation and improvements. I would enjoy hearing from anyone who has made any of these, or other, modifications.

The Atari Editor/Assembler cartridge was used to develop VISIFAX. The source-code file should be compatible (with a few minor modifications) with any 6502 assembler you might happen to have.

Where To Get the Program

For a fee of $5.00 to cover my expenses, I will send you an Atari DOS 2.0S formatted diskette (containing the VISIFAX program in source, object, and listing forms), the tone-detector schematic, and other various notes. I cannot accept any CODs or credit cards. The package is available from me at the address given at the beginning of this article. ■

Dave Miller K9POX
7462 Lawler Avenue
Niles IL 60648

NOAA's 2m UFO

Your weather radio is a great signal source on 145.8 MHz. K9POX explains why.

No, not the kind that shuttled ET to Earth, but Unidentified Formidable Oscillations that can cause your synthesized scanning transceiver to always stop at a certain frequency. There's a strong carrier present with no modulation, and it can't be heard at your friend's house just a block away! With all of the gadgets and gizmos available today ready and willing to present potential interference problems on our ham bands (computers, video games, VCRs, etc.), I recently ran across yet another very strong source, right in the middle of our precious two-meter band. I don't know if anything has been previously written on this one; if so, I've not seen it anywhere, so here goes!

As most hams are no doubt aware, our federal government sponsors a network of very useful VHF radio stations in the 162-MHz portion of the spectrum known as the NOAA weather radio system. The National Oceanic and Atmospheric Administration (NOAA) supports these stations with staff and funding to provide excellent, up-to-date weather information 24 hours a day for a given geographical area.

The stations are very helpful to private pilots, boaters, the farming community, out-of-doors tradesmen, and much of the remaining public in general. For a while there was some talk of terminating NOAA weather radio for reasons of economy (budget cutting), but the latest word seems to be that the service will continue as it has in the past...thank goodness.

NOAA weather radio provides another service for those who wish to avail themselves of it, i.e., an automatic-tone-alerting feature during times of potentially dangerous conditions. NOAA will transmit a steady audio tone of 1,050 Hz (for 10 seconds or so) to automatically trigger a siren-like signal and/or turn up the volume on an "alerting" model receiver to warn the owner of dangerous conditions and allow him or her time to "batten down the hatches." This is obviously a very useful feature to have, but you must leave the radio on and in stand-by at all times, which is not a particular problem today with very low-current-drain, reliable, solid-state receivers.

Now that the background has been sketched in, let's take a look at the problem that was promised in the beginning of the article. Most of the better weather radios (especially those with the alerting feature) are quartz-crystal-controlled units. Many have more than one switch-selectable channel, each crystal controlled, with two i-fs (high and low) each with crystal-controlled local oscillators, and all done with *one* crystal.

Being the curious type that I am, I had to find out how they did all of this with just one silly crystal, and Fig. 1 is the block diagram of what I found out. Three of the weather radios that I have (each of different manufacture) use the very clever scheme of Fig. 1 and offer three switch-selectable channels on 162.55, 162.475, and 162.40 MHz. Beginning with the middle channel of 162.475 MHz, a 16.2020-MHz crystal is used to control oscillator Q3 by grounding the "low" end of the crystal itself. This 16.2020-

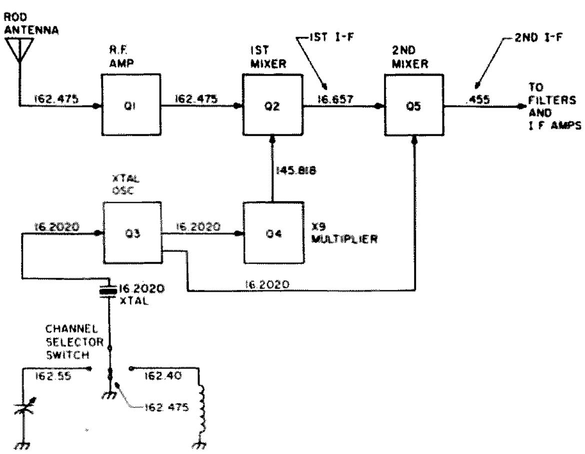


Fig. 1. Inside a weather radio.

MHz signal is then multiplied by 9 to 145.8180 MHz and mixed in Q2 with the amplified incoming NOAA frequency of 162.475 MHz. The difference signal of 16.6570 MHz (1st i-f) is then mixed with the original 16.2020-MHz crystal frequency in Q5 to produce a difference frequency of .455 MHz or the 455-kHz 2nd i-f. The 455-kHz 2nd i-f is then further filtered, amplified, and de-modulated to produce an audio output from the receiver. . . clever, eh?

A similar scheme is used for the 162.55-MHz channel, but in this case the 16.2020 crystal has a trimmer capacitor inserted between its "low" end and ground. This has the effect of raising the natural resonant frequency of the crystal from 16.2020 to 16.2095 MHz, which when multiplied by 9 produces 145.8855 MHz, which is beat with the incoming 162.55 MHz to produce a 1st i-f of 16.6645 MHz, which is beat again with 16.2095 MHz to produce a 455-kHz 2nd i-f.

The last channel (NOAA frequency 162.40 MHz) has an inductance between the "low" end of the 16.2020-MHz crystal and ground, which lowers the natural frequency. The crystal now puts out 16.1945 MHz, times 9 to 145.7505 MHz, beat with 162.40 MHz to produce a 1st i-f of 16.6495 MHz, beat again with 16.1945 MHz to produce a 2nd i-f of 455 kHz once again. Notice that the 2nd i-f is always 455 kHz, but that the 1st i-f is 16.657, 16.6645, or 16.6495 MHz. The 1st i-f is a single stage and is rather broadly tuned to accommodate this spread of frequencies. Very clever, indeed!

You've undoubtedly already noticed that the 1st i-f local-oscillator output falls in the high 145-MHz region. . . right in the middle of our 2-meter ham band! That, of course, is the problem. Fig. 2 shows the various possible NOAA weather channels (1 to 7), their actual frequencies, the fundamental crystal 16-MHz frequency, and the 145-MHz product of multiplying that frequency by nine.

NOAA Channel	NOAA Frequency	Crystal Fundamental	Multiplied Frequency
1	162.550	16.2095	145.8855
2	162.400	16.1945	145.7505
3	162.475	16.2020	145.8180
4	162.425	16.1970	145.7730
5	162.450	16.1995	145.7955
6	162.500	16.2045	145.8405
7	162.525	16.2070	145.8630

All frequencies shown are in MHz.

Fig. 2. NOAA frequencies.

As can be seen, the 2-meter product can range anywhere from 145.773 to 145.8855 MHz, depending upon which channel the weather radio is tuned to, theoretically. I say theoretically because the *actual* frequency depends entirely upon how accurately the crystal at 16 MHz is tuned in the individual weather radio. I've found the crystal fundamental to be off by as much as 1 kHz, which would translate into a 9-kHz difference from the 145-MHz frequencies shown in Fig. 2. Don't be too surprised at this, because the error can be compensated for by detuning the i-f stages in the weather radio from the "standard" shown without much loss of sensitivity.

As an example, suppose that the 16.2020-MHz crystal for receiving NOAA on 162.475 MHz was actually 16.2021 MHz (1 kHz higher). The 16.2021 multiplied by 9 would yield 145.809 MHz, which, subtracted from 162.475 MHz, gives a 1st i-f of 16.666 MHz; subtracting 16.2021 results in a 2nd i-f of 465 kHz instead of 455 kHz. If the 2nd i-f chain were detuned slightly somewhere between 455 and 465 kHz, the sensitivity of the weather radio would still be quite acceptable, but the 2-meter band product would be 9 kHz down from where you might expect to find it. You're welcome to calculate the rest of the possibilities for yourself if you wish. By the way, the formula for determining the crystal frequency is: Crystal Frequency = (Receive Frequency − .455)/10. All frequencies are, of course, in MHz.

Now you might be wondering how the 1st i-f local-oscillator (X9) product can cause any trouble at 145 MHz more than a few inches away from the weather radio. It shouldn't, of course, but after all, this is the *real* world!

I invite you to try it if you're at all skeptical. Just go into a store that sells weather radios, armed with your nifty synthesized HT, and ask to demo one of the sets. The Radio Shack 12-154 is a good candidate. I'm not picking on this receiver. In fact, I'm very pleased with the sensitivity and performance of mine, but it does put out a very formidable oscillation on 145 MHz; so do other brands.

Radio Shack stores are located all over the country and are usually very willing to give a demo of their products to the customer. So there, no excuse! I haven't really tried to "clean up" a weather radio to reduce this formidable oscillation in the 2-meter band (it's no longer unidentified), but I would suspect that it could be at least reduced if someone wants to try (and hopefully write a follow-up article to this one).

A good place to start would be to install a series-resonant trap right in the antenna lead close to the rf amp input and tuned to 145.80 MHz. I suspect that there is a fair amount of local-oscillator leakage around the rf amp and up the antenna itself. This idea worked quite well on a cordless telephone whose local-oscillator 2nd harmonic, 39.130 MHz × 2 (78.26 MHz), was creating a good bit of TVI on TV Channel 5 (76 to 82 MHz) and interfering with any nearby TV sets.

Other approaches to the weather-radio radiation problem might include better rf bypassing (with .001-uF disc caps) on the dc lines, ferrite beads on the various unshielded wires inside to discourage them from being "antennas," painting a conductive coating on the inside of the plastic cabinet, etc. All of these suggestions will most probably help to some extent, and the sum total could be surprisingly effective.

Of course, you can always unplug the weather radio (a sure cure) if it's yours. If it's in a neighbor's home, then it's time to become a diplomat. Let us all know your negotiating secrets. Then there is always the bright side of the picture: The 145.8855-MHz signal makes a dandy marker for a quick check of your 2-meter receiver's sensitivity. In fact, you can put your battery-operated (most have this feature) weather radio out in the backyard with a metal pail over it for a pretty decent "weak signal" source for tuning up your 2-meter receiver (adjust pail for desired signal strength). It's best to do this after dark so that no one will question your actions.

I haven't yet mentioned the fourth weather radio that I have that uses a 49.990-MHz crystal and makes a great 6-meter lower-band-edge marker with just a slight retuning.

Maybe some clouds actually do have silver linings. I guess it all depends upon your objectives and approach.■

Marc Stern N1BLH
c/o 73 Magazine
Peterborough NH 03458

Secrets of Cellular Radio

Take a guided tour behind the scenes of our newest repeater technology.

What would happen if you set up a network of transceivers, linked them via a twisted-pair loop, controlled the whole setup with a master station, used polling and diversity reception, relied on FM capture and low power, and put it all at UHF?

Would you be: (A) establishing a sophisticated repeater network; (B) establishing a sophisticated auxiliary system; (C) establishing a cellular phone system, or (D) none of the above?

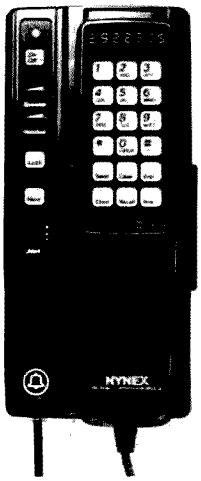


Fig. 1. The NYNEX Mobile Communications™ mobile telephone. (Courtesy of NYNEX)

The answer to this question is (C) although it does sound as if you are setting up either a sophisticated repeater or auxiliary communications system because that's essentially what the newest mobile-telecommunications system actually is. The nationwide network of commercial mobile-cellular systems now rapidly being established is little more than a series of UHF repeaters tied together by a twisted-pair loop and controlled by a computerized master station or mobile-telephone switching office.

Today's cellular communications system grew out of a test which was set up in Chicago in the 1970s. That system, called the Advance Mobile Phone System, was a test bed where the concepts now central to the cellular phone system were proven. Using a special Federal Communications Commission authorization, American Telephone & Telegraph (which controlled the Chicago-area telephone-operating company at the time) used frequencies in the 800-MHz spectrum to prove a cellular system would work.

The aim of the system was to end the overcrowding and limited access to the conventional VHF mobile-phone system which could accommodate only 1,200 users per market and which created long waiting lists for new subscribers. (The conventional system relies on one high-powered transmitter and receiver at a central location; all the mobile phones in an area talk through it. Because the number of frequencies available was limited, there was little room for more than a few conversations. The cellular system ends this.)

Cellular mobile communication takes advantage of two concepts which have been known in amateur radio circles for a number of years: capture effect and low power. Both interplay in the cellular system, so spectrum is much more efficiently reused and the number of users on a typical system can increase dramatically—by a factor of 100 or more.

The way this works is simple. The typical cellular mobile phone puts out somewhere between one and five Watts, depending on conditions. A microprocessor inside the phone unit communicates digitally with a computer at a cell site's fixed transceiver to determine the output needed for reliable communication. Typically, this output is somewhere around three Watts, although it can drop dramatically as the mobile unit approaches the fixed site. Whatever the amount of power, though, it is enough to capture the front end of the fixed transceiver on whatever frequency pair may be accessed by the computers. (The actual choice of frequencies is left to the microprocessors. They search their particular range of transmit and receive frequencies for an open pair and then establish a link between the mobile unit and the cell site.)

Because the front end of the cell-site transceiver is captured, the radio "hears" only the particular radio with which it is communicating and no others. Here's where the interplay between capture and low power takes place. Because the

unit is operating on low power, neighboring cell sites—more about that in a few minutes—will not hear the conversation which is going on between the mobile and the fixed site. This enables the same pair of frequencies to be reused in a neighboring cell site, where another mobile unit will capture and hold them. All this is done without the user knowing it's going on.

(Actually, this is a simplified picture of what is going on with the cellular mobile phone system, but it does show how concepts we know about are applied in other radio services, of which the cellular system is one.)

To define the exact nature of the cellular phone system, picture a map of your city and then overlay a honeycomb pattern of six-sided cells on that map. This is the cellular system. Each cell has a fixed transceiver site at its center. The fixed-site transceivers are, in turn, connected by wireline link to a computerized master site—the mobile-telephone switching office (MTSO). The entire system is linked by the MTSO to the rest of the phone system.

Why were six-sided cells chosen? It was an arbitrary decision made when the system was under development in Chicago. The actual shape of a cell can be just about anything and is as much guided by local terrain as anything else. The size of a typical cell is also arbitrary and will change over time as the system gains more and more users. The reason the size will change is another of the advantages of the cellular system.

To accommodate a growing number of users, the size of a cell pattern can be cut and more cell-site transceivers added. As this is happening, the power levels used throughout the system will be cut accordingly so that more units can use the system without interfering with one another.

Since there is so much spectrum available and since the power levels will be very low, there will be little or no interference between units. Units which may be attempting to access a frequency pair that is in use and which may be on the fringes of a cell just won't be heard by the cellular system because stronger units will have captured it. These units will have to wait until their signals are at quality levels where the system will accept them. As you can see, then, the cellular system is designed to collapse in on itself to be able to increase the number of users.

This system works on frequencies in the 800-MHz spectrum. The FCC allocated about 40 MHz of band space, so this service can provide as many as 666 channels for full-duplex communication in a given area. Thanks to low power and FM capture effect, one cell can support 333 calls at any one moment, as a neighboring cell also handles 333 calls.

To understand better how this system works, let's suppose that you are the person using a cellular phone and you are placing a call. When you first pick up the handset, a digital signal is sent from a microprocessor in the mobile unit to the nearest cell's central transceiver. That signal says, in effect, "Hey, wake up, I want to make a call." Within milliseconds, the cell site says, "Okay, wait a minute," and the microcomputers begin searching for an open frequency pair. The lower frequency (845 MHz, for instance) is used for transmit and the upper frequency (872.3 MHz, or whatever) is used for receive. When open frequencies are found, the cell-site transceiver sends a signal back to the mobile unit telling it to begin the call.

The next thing you hear in the handset is the dial tone; you can dial the number you want, and the call is placed. As the call progresses, both the cell-site transceiver and the mobile unit are in constant communication, well below the carrier, in a digital mode. Some of this communication is regarding billing,

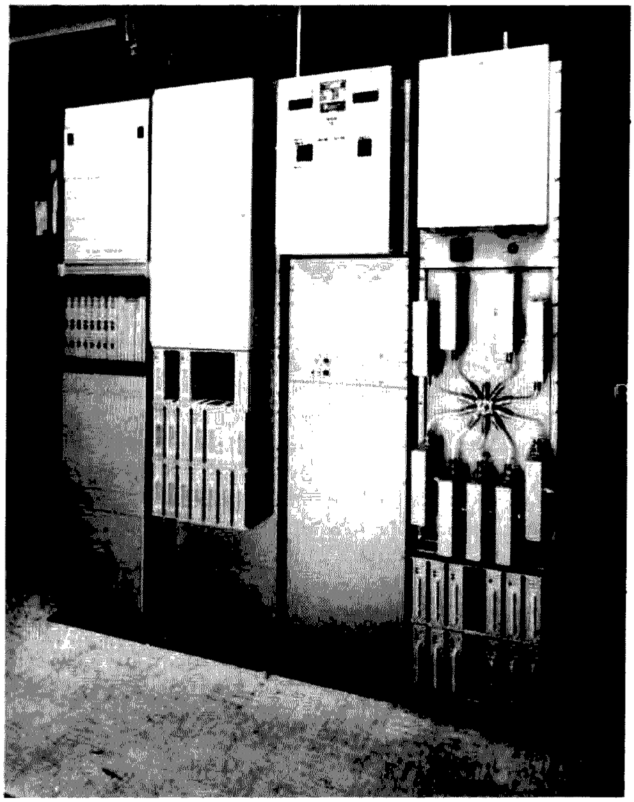


Fig. 2. Motorola's Dyna T•A•C base station. (Courtesy of Motorola)

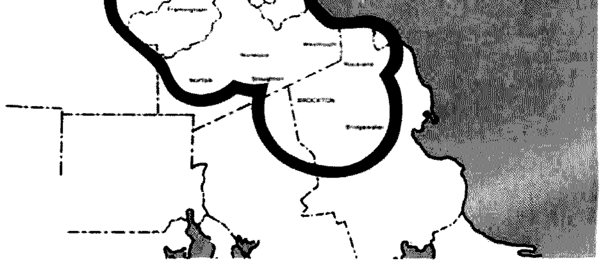


Fig. 3. The Boston Cellular Geographic Service Area (CGSA), where NYNEX Mobile Communications Company initially provides cellular mobile phone service. The area covers about 1,800 square miles, has an estimated population of 3.6 million, and services area code 617. NYNEX plans to expand the coverage area to include New Bedford, Worcester, and Springfield, Massachusetts, and Providence, Rhode Island.

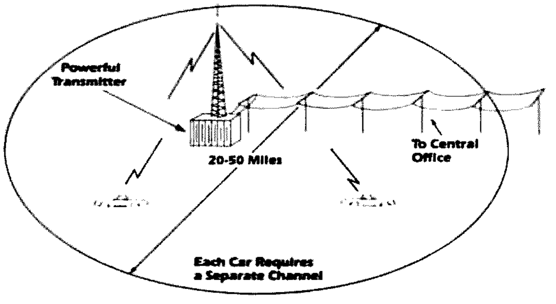


Fig. 4. Conventional mobile-telephone service uses one central base station to transmit a powerful radio signal over an area up to 50 miles in diameter. Only one two-way conversation at one time can be conducted over a given channel anywhere in the coverage area, and the number of channels is limited. This process restricts service availability and increases chances that a call will be blocked.

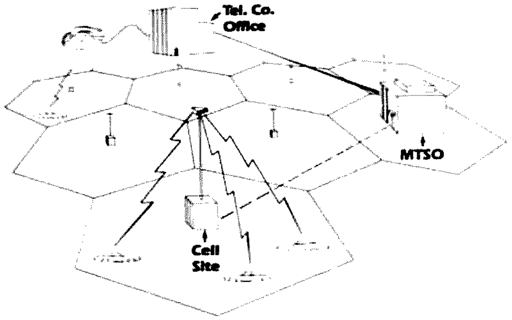


Fig. 5. Cellular mobile-telephone service is provided through a system composed of three major elements: cell sites, a mobile-telephone switching office (MTSO), and dedicated interconnecting circuits. The cellular system is divided into smaller geographic areas called cells. Adjacent cells are assigned different sets of frequencies. Cells sufficiently far apart can use the same frequencies simultaneously. This permits the reuse of a single channel many times within a given service area, allowing hundreds of conversations to occur at once.

while much of it is about signal strength and quality.

Let's say you are moving away from the cell-site transceiver. As you do, the cell-site transceiver, which is watching the signal strength, senses that the gap is widening between the mobile unit and the central site. As the gap widens, it sends a command to the mobile unit to increase its power output, to which the mobile unit responds. The system tries to maintain a quality ratio of 17-dB C/I and a signal quality level of 18-dB C/N. As the gap widens further, the cell site orders the mobile unit to further increase its power, to which the mobile unit responds again. This will continue happening until the cell site learns the mobile unit is transmitting at full power.

Now let's say you continue moving away from the cell site, and even with maximum power the signal quality begins to drop. At this point, the cell site performs another of its chores. The entire cellular system is polled digitally as a new path is sought for your call. When that path is found the call is switched within 50 milliseconds. The switch is so fast that the normal user will never know it has happened.

The handoff, the switch from cell A to cell B, is actually more complicated than it looks—on a digital level, at least. The mobile unit must not only switch from cell A to cell B while keeping the signal quality up, but also it may have to switch frequencies to a new pair because the original pair on which the call was established in cell A may be in use in cell B. The transceiver may not only make the jump between sites but also between frequencies. The microprocessor inside the phone is usually extremely busy, therefore, at all times.

As you can see, frequency agility is built into this system; it is a function of the digital electronics used for control. But the cellular system isn't totally digital in nature because it relies on radio-frequency basics with which we are familiar. We've already noted how the UHF cellular system takes advantage of capture effect and low power, but we haven't noted how it takes advantage of diversity reception.

If you were to look at the typical cell-site antenna tower, you would see not one antenna but three, six, or more, arranged in a triangle. These antennas are handling not only transmission but also reception, and the cell site monitors all of them. As you travel through a cell during your call, the cell-site transceiver watches the received signal strength on all its antennas. It routinely polls those antennas to see where the strongest signal is, and when it finds the strongest signal it uses that antenna for operation.

If you were to watch the cell site as you move along, you would see the signal moving from antenna to antenna as your position changed. From this you can see that although digital polling is used the system is still turning to the best antenna among many for reception, for "diversity reception." I grant you that it may not be total diversity reception since only one receiver is used and digital electronics takes the place of the others needed, but it's a modern equivalent, to say the least.

By now you probably have noticed that both the mobile unit and the cell-site transceiver are very capable units. Not only must they handle such mundane chores as identification and billing information, but they also must handle establishing the proper frequencies and setting proper power levels. The system is made up of a number of frequency-agile units. The cell-site transceiver is even more capable because it must not only handle these functions but also monitor the mobile unit's location, bearing, and direction from the cell site, to determine which antenna is best or whether it's time to ask for a handoff to the next site. It's quite a system, and it wouldn't have been possible without the modern microprocessor.

The system does suffer from the various problems long known to avid VHF and UHFers, of course, signal loss, multipath, and reflection. However, the microcomputers in the system are programmed to handle this. Further, since the frequency spectrum where the system is located is very much line-of-sight, its range can be limited if the cell site's antenna isn't in an optimum location. Still, it manages to overcome these obstacles to provide reliable communications to hundreds of thousands of users across the country. No longer is a mobile radiotelephone a symbol of an elite class of users, because cellular radiotelephone opens this realm to just about anyone.

What does this all mean for us? For one thing, it likely points to the route equipment will be following during the next few years. Looking at the cellular system from strictly a mobile standpoint, you will find the units to be frequency-agile

FM transceivers which are capable of increasing or decreasing their power levels automatically. Some of the units on the market also have memory-dialing capability, being able to store 10 or more commonly-called numbers, and most of them can be programmed with security passwords and other goodies. And, you will find as you look at the equipment available, that not only are more traditional mobile phones available, but there also are hand-held portables available.

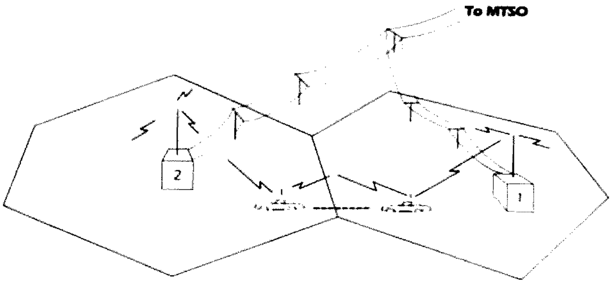


Fig. 6. Cellular handoff makes mobile communications possible and helps ensure service quality. As a customer with a call in progress moves from cell to cell, electronic equipment in the mobile-telephone switching office automatically transfers or "hands off" the call to the next cell site. There are no apparent changes in voice transmission quality, and the call continues uninterrupted.

Imagine, then, what will happen when local repeaters are able to control power-output levels and when you can store needed information in your mobile rig! Levels of local splatter and QRM will certainly come down, and it will make the mobile rig more convenient to operate, especially through the phone patch. Further, imagine what it will mean when we can link a network of repeaters into a cellular format routinely. Mobile units will be able to carry on reliable communications not just for 50 miles, but, potentially, for hundreds of miles. Also, imagine if we tap the direction-finding capabilities of a cellular system. It will help us keep our own spectrum cleaner, also. And these are just a few of the possible uses of cellular technology. It's quite likely our experimentation will lead to many more.

In the near term, though, the cellular radiotelephone system has immediate impact on the 900-MHz band which will be opening to us. If you look through the pages of any current amateur publication, you will see rigs for 2 meters, 220 MHz, 440 MHz, and even 1296—but not for 902-928. Since the cellular system operates just below our spectrum—it tops out at about 895 MHz—it won't be too hard to retune cellular mobile units for our own use and it won't be hard to retune base-site units for repeater use. Of course, it will be some time before these units are available in traditional used-equipment channels, but when they are it will mean an exciting new technological opportunity.

Finally, the cellular radio, with its emphasis on low power and spectrum reuse, will likely mean some new concepts for us. Instead of using QRO all the time we'll need only the amount of power, at any given moment, for reliable communications. If a cellular-like repeater system is built, imagine how many people it will be able to support!

Cellular technology is here now and its possibilities are exciting. It remains only for us to pick up on them. ■

Robinson Markel W2IVS
405 Lexington Avenue, 18th Floor
New York NY 10174

The Santec Spectacular

Is your Santec becoming forgetful? Are its batteries going soft? No more! Here are two quick mods that bring your hand-held to within an inch of perfection.

In the October, 1983, issue of *73*, I described in detail the virtues and vices (only one vice, actually) of the Santec ST-144, -220, and -440/uP hand-held radios. Good as they are, there is room for improvement. This article describes two battery-related ideas. The first prevents a loss of memory when the main battery is removed (or is dead) for extended periods of time. The second is a simple method of avoiding nicad "memory," the bane of the rechargeable-battery user. Both will work on the new ST-142, -222, and -442 also. Let's go.

Lithium-Battery Backup

The memory backup system in the ST-/uP radios is 440 uF of capacitance which is kept charged as long as the battery is connected (and kept at a reasonable charge level). Disconnect the battery and you have about thirty seconds to connect a new one, otherwise all is lost (meaning the memories, the scan interval, and the clock time). The addition of a 3-volt lithium battery and a 1N914-type diode will provide many hours of memory backup.

The ideal battery is available from Allied Electronics, catalog number 884-0435. It is made in Japan by Matsushita (Panasonic here), designated BR-435, and says it is "for electronic fish float." It is a small cylinder, 4.19 mm (0.165 inches) in diameter by 35.89 mm (1.413 inches) long, with a short wire terminal at one end. The case is positive and the protruding wire terminal is negative. Both the case and the negative terminal are made of aluminum, so you will need some Sal-Met™ flux or other aluminum soldering aid. *Caution:* Lithium batteries, like a number of others, can explode if subjected to high heat. Don't use a high-wattage iron or gun. A small pencil-tip soldering iron is all you need for this job. Fig. 1 shows the connections to make. The series diode prevents the lithium battery from being charged by the main battery.

The lithium battery fits inside the front cover. To open the cover, remove the two screws under the back cover in the empty space below the battery, and the front cover can be swung aside on its flexible PC connector. The connector is pretty durable, but care should be used in handling the separated pieces of the radio. You can pull the end of the flexible connector from its socket on the main PC board, but be careful not to crease it when removing or reinserting.

The lithium battery will rest above the microprocessor PC board, in the slot between the PC board and the top of the cover. Photo A shows the placement, with the wires toward the center of the cover. In order to have the battery fit properly, a small amount of material needs to be removed from the plastic boss that retains the top of the loudspeaker. This is easily done with the tip of a small soldering iron. Use a tip that is close to the same diameter as the battery. The battery case needs to be insulated (shrink tubing is fine, but again, watch the heat).

It is best to connect the lithium battery while the main battery is in the circuit; this avoids possible "crashing" of the microprocessor. Here's how you do it. First, connect the positive lead of the lithium battery (actually the cathode of its series diode) to the cathode end of D209. To find D209, remove the four small Phillips screws holding the microprocessor board and tilt the board up on the flexible connector. Locate C5 (component identification is on the top side of the board, and C5 is one of the two 220-uF miniature electrolytic capacitors near the upper end). D209 is the diode that is connected underneath the board to the positive side of

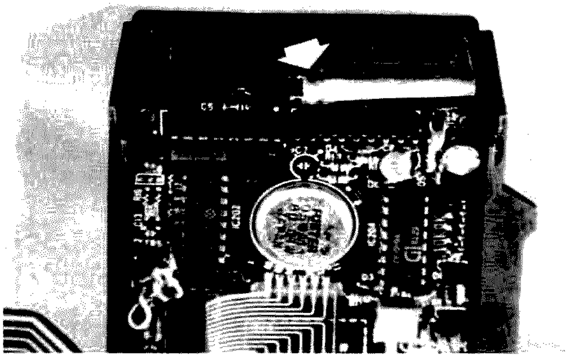


Photo A. Backup lithium cell installed in the front cover. Connections are made to the leads of C5.

C5; in most radios there is 10k of resistance in parallel with D209. You want the end of the diode that is *not* connected to C5, that is, the end nearest the loudspeaker clearance hole. Some radios may have neither D209 nor the parallel resistor installed. If yours is one of them, just connect the positive lithium-battery lead to the positive lead of C5. Don't connect the negative lithium-battery lead yet.

Now, if you unplugged the flexible PC from the main board, plug it back in. Turn on the radio and make sure you get the "cold-start" frequency (146.520, 223.500, or 446.000 MHz, depending on the radio). If you don't, disconnect the main battery for at least 60 seconds, replace it, and check again. Now turn the radio off (but leave the main battery connected) and connect the negative lead (case) of the lithium battery to the negative side of C5. The battery lead can be soldered to the capacitor lead just where it enters the board from below (using a micro-tip iron). This placement will allow you to disconnect it (using a fine-tip soldering iron) in case there is ever a microprocessor crash. Turn the radio on once more to check for the cold-start frequency. Now put any frequency other than the cold-start into memory 1. Once more disconnect the main battery for at least 60 seconds. Reconnect it and you should still see your stored frequency (if the cold-start frequency comes back, check your lithium-battery connection). Replace the microprocessor board into the front cover.

In operation with the main battery inserted, C5 and its companion are charged to about 6 volts. The diode prevents the lithium battery from being charged at the same time. When the main battery is disconnected and the capacitors discharge below about 2.5 volts, the lithium

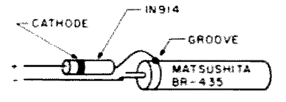


Fig. 1. Connections to Matsushita BR-435 lithium backup battery.

battery takes over. So far, mine has maintained the memories for periods of up to 24 hours with a fully discharged main battery. There isn't any reason to think it won't last longer; I just haven't experimented.

One final word: Should the microprocessor ever crash or lock up, simply remove the main battery, open the front cover, and disconnect the negative side of the lithium battery from C5 (which you can do easily with a small soldering iron). Leave it disconnected long enough for memory erasure to occur (60 seconds is plenty), then check for the cold-start frequency display at turn-on. Reconnect the lithium battery.

Battery Discharger

That's right, *discharger*. This one is for the main battery. Many articles about nicad batteries describe the "memory" effect that results from repeated recharging after only partial discharging. After a few months of operating the ST-/uP radios, I noted a distinct shortening of useful life attributable to my tendency to put the batteries on charge as soon as the low-battery indicator on the radio began to flash. Discharging a fully-charged battery into a resistor load confirmed my suspicion; at a 500-mA discharge rate, typical battery life was 40 minutes to a cell voltage of 1.0 volt. A new battery took more than 60 minutes to reach the same point!

The same articles point out that the cure for nicad memory is several full discharge/charge cycles. Sure enough, after five or six of these, battery life increased to 62 minutes for one of the

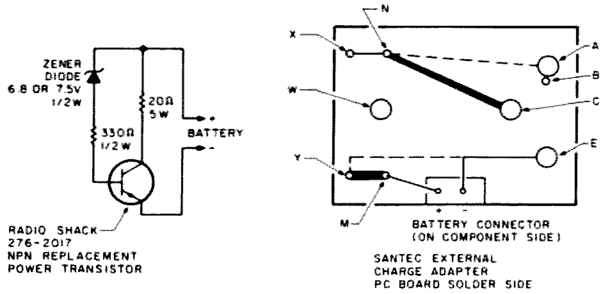


Fig. 2. Schematic and layout drawings for battery discharger (K5VOU version). Dotted lines on the layout diagram indicate removed foils; heavy solid lines are added jumpers.

original batteries and 70 minutes for the other.

To maintain battery "forgetfulness," I constructed a simple discharger using the "external charge adapter" manufactured by Santec (designated ST-EC). This is a small PC board containing a male dc power jack, a series diode, and a battery connector. The power jack and diode are removed and, in the simplest possible version, a 20-Ohm, 5-Watt resistor is placed across the battery connector. I added a subminiature metering jack (with 200 or 300 Ohms of series resistance to prevent shorts when a meter is plugged in) for easier reading of the battery voltage.

If you leave the simple discharger connected for too long a time, there is a risk of reverse-charging one or more of the cells, although I have not had this happen to any of my four batteries. To eliminate that risk, Tom Gentry K5VOU, who is President of Encomm, the Santec importer, suggested the circuit shown in Fig. 2. I constructed this on the external charge-adapter PC board, using Radio Shack parts and the layout in Fig. 2. The circuit stops discharging the battery when the zener voltage is reached. Referring to Fig. 2, remove the diode from holes M and N and the plastic battery-charger socket from A, C, and E. Leave the white plastic battery connector and its pins. Cut away the foils as shown by the dotted lines and add the jumpers indicated by the two heavy lines. Drill hole W (diameter 3.2 mm or 1/8") for mounting the transistor, being sure to place it so as to leave enough lead length for the transistor leads to reach holes B, C, and E. Mount the transistor on the component side and connect its B, C, and E leads to holes B, C, and E. Connect a 20-Ohm, 5-Watt resistor between X and Y. Solder a 6.8- or 7.5-volt, 1/2-Watt zener diode in series with a 330-Ohm, 1/2-Watt resistor, with the diode anode toward the resistor. Insulate the combination and connect it on the foil side with the diode cathode going to hole M and the free end of the resistor to hole A. That's it.

When the ST-/uP radio's battery indicator begins flashing, replace the battery and plug the used one into the discharger for an hour or so before recharging. This will fully dishcarge the battery and prevent memorization. Caution: the discharge resistor and the transistor in Gentry's circuit get hot for a while; don't let the discharger touch anything flammable.

The battery-related modifications described in this article will add to your Santec operating pleasure. The time between battery rechargings will stay at its original figure, and if you overdo it and absolutely kill the battery, at least you won't lose all the memory information. Have fun! ■

Saga of the Willie Wand

W5RRH learned a new technique while building this 6-element 2m beam. It's called cut and try and try and try.

Ed Mahoney W5RRH
3008 S. Norwood
Tulsa OK 74114

It probably would be better to name this article "Willie," since it contains as much information about him as it does about his antenna, which I named the "Willie Wand Special."

Willie W5FXP is one of those unique individuals that you have the pleasure of knowing only once in a lifetime. He first entered my circle of awareness as an instructor at the technical school I decided to attend about 35 years ago. One of the subjects he taught was antennas. It was hard not to absorb some of his theoretical and practical knowledge about antennas, since he entered into the task of beating some smarts into those dumb students with his usual enthusiasm.

It was at this time that I managed to become an amateur-radio operator—again largely due to Willie's enthusiasm for the hobby. Willie had been a ham for 15 years, having acquired his ticket back in 1935.

After graduation, I kind of lost touch with Willie, partially because the technical school folded, but mostly because I drifted away from ham radio. As I found out later, Willie went to work for one of the major aircraft manufacturers, migrating eventually to their radiation laboratory, designing and testing antennas, naturally.

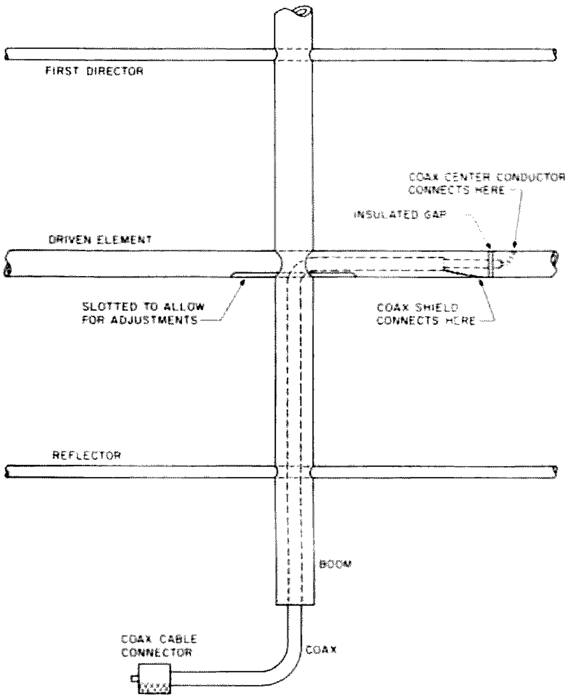
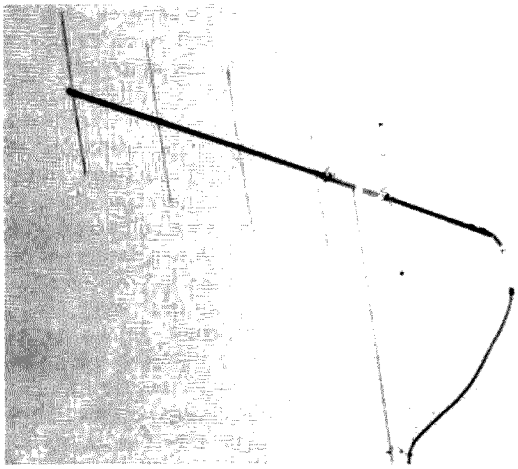


Fig. 1. Coax connections.



The Willie Wand Special.

About 33 years later, when I was just messing around with a 2-meter handie-talkie, I flipped it over to 5-2 simplex and there was Willie's unmistakable voice. As a result of this accidental QSO, I became an enthusiastic reborn ham-radio operator, acquiring the necessary equipment to get on 2 meters and chew the rag with Willie and his friends. This was timely, however, since I retired shortly thereafter and was needing something to fill the 8-hour-a-day void.

One of Willie's daily routines consists of getting on 2 meters at precisely 8:00 am every (and I do mean every) morning to chew the rag with his lifetime friend Clarence W5FDP, who lives in Muskogee, Oklahoma. These morning sessions were (and are) quite informative and entertaining. Quite a few hams just monitor these QSOs, reluctant to join in because of the long-winded transmissions, some sorely stretching the 10-minute ID time limit. In fact, they have their own exclusive simplex frequency since most of their transmissions would time-out just about any repeater.

I gradually became a member of this "Social Security" net. Initially, my 2-meter antenna system consisted of a well-known commercial collinear vertical (Willie called it an inverted ground rod). This worked fine for local QSOs, but sometimes it wouldn't quite hit Muskogee, about 40 miles away. Finally, out of exasperation, Willie offered to build me a beam antenna. Knowing that anything Willie built would be almost perfect, I accepted the offer before he had a chance to back out.

Naturally, this antenna became the main topic of quite a few 8:00-am SS nets, every aspect being thoroughly reviewed by all participants. During one of these sessions, the matching network became one of the topics, most methods being thoroughly discussed. As a side note, Willie mentioned a matching technique that he had successfully used previously on a vertical antenna. This caught my attention, so I suggested that we try it out on my antenna. Willie jumped at the chance.

Basically, this matching method consists of a series-fed driven element, with the coax cable entering the reflector end of the boom, then going on into the driven element through a slot located in the center of the driven element (where it passes through the boom), continuing on out to an insulated gap on one end of the driven element. The coax shield is then connected to the boom side of the driven element while the coax center conductor passes through an insulator and then connects to the end stub (see Fig. 1). If the insulated gap is properly located, the impedance will be 50 Ohms—a perfect match.

Willie decided that my antenna should consist of six elements with a fiberglass boom. After scrounging around, I managed to come up with enough 5/16-inch-diameter aluminum tubing for the directors and reflector. The boom was to be constructed of 1¼-inch fiberglass tubing (which Willie already had). To allow room for the coax cable and fitting, we decided to use ⅝-inch aluminum tubing for the driven element (which Willie also had).

After several more SS net sessions, most parties favored using a hoodless PL-259 connector to terminate the coax cable (Willie's idea). With a little refinement in Willie's vertical mill (drill press), the PL-259 connector was turned down to be a snug fit in the end of the ⅝-inch driven element. The fitting was then permanently fixed in place with a short setscrew, the hole drilled and tapped through both the tubing and the meaty part of the PL-259 connector. Naturally, the coax cable was properly attached and strung through the boom and driven element before everything was connected permanently. RG-142 coax was used since it is small in diameter (approximately the size of RG-58) and has a Teflon™ dielectric.

For attaching the PL-259 center conductor, a brass bushing was likewise milled to the right size on the vertical mill, the hole in the bushing drilled out to fit the PL-259 pin. Again, a setscrew made this a permanent connection, the screw passing through the ⅝-inch tubing and brass bushing and making contact with the PL-259 center pin. Before this was assembled, however, a Teflon washer was slid onto the PL-259 center pin, providing an insulating barrier between the two pieces of the driven element (see Fig. 2).

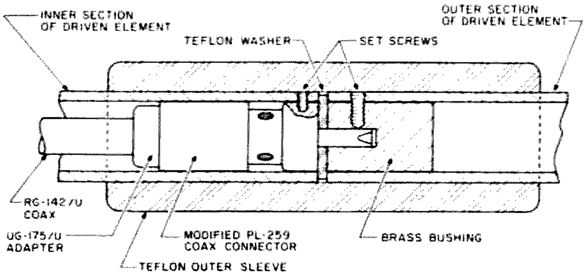


Fig. 2. Detail of coax connection.

The basic antenna design was acquired from the NBS Circular, *Technical Notes For Yagi Antenna Design* (NBS-TN-688). Willie didn't know where to place the feedpoint, so for the initial try we decided to try it approximately ⅛ wavelength from the center—this being about 9½ inches.

Willie had the antenna assembled and ready for testing practically overnight (at least it seemed that way to me). As usual, he did an exceptional job, the elements firmly attached to the boom, straight and spaced within 1/64 inch of perfection. Next to come was the tuning and feedpoint adjustment.

Now, Willie doesn't settle for measuring swr down to 0.1 resolution. He has his own special swr meter which reads 2 to 1 at full scale. Added refinements include a dummy load, an attenuator, and calibration load resistors for exact calibration. With the dummy load and attenuator, measurements and tuning adjustments can

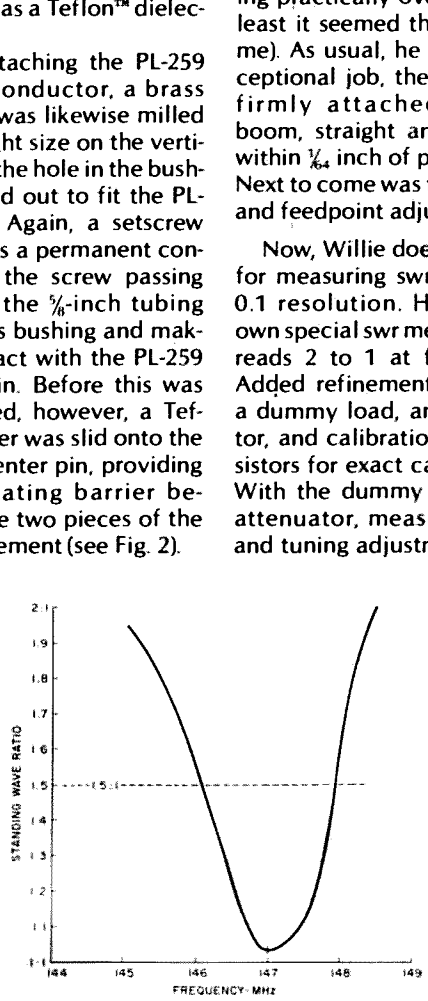


Fig. 3.

Reflector and director material	$\frac{5}{16}$-inch aluminum tubing
Driven-element material	$\frac{3}{8}$-inch aluminum tubing
Boom material	1-inch fiberglass tubing
Boom length	9 feet
Reflector length	38.95 inches
First director length	35.57 inches
Second director length	35.05 inches
Third director length	35.05 inches
Fourth director length	35.57 inches
Director spacing	20.075 inches
Reflector spacing	16.06 inches
Driven-element total length	35.688 inches
Driven element, center to feedpoint	11.91 inches
Driven element, feedpoint to end	5.938 inches
Estimated gain	10.25 dB

Table 1. Specs for 147-MHz, 6-element beam antenna.

be accomplished without worrying about the transmitter mismatch.

The initial tuning and alignment session didn't pan out too well. The antenna was resonant at about 145 MHz (target frequency was 147 MHz), and the feedpoint impedance wasn't even close. After much trimming, we managed to get the length about right, but the feedpoint impedance was still off. The length of the driven element had to be reduced to 35$\frac{11}{16}$ inches in order to achieve resonance at 147 MHz.

The next tuning session consisted of cutting short pieces off the end stub, reattaching these pieces to the opposite end of the driven element (on the other side of the boom), then re-centering the whole element. This in effect moved the feedpoint out from the boom. This continued for several sessions, the final result being a feedpoint 11$\frac{29}{32}$ inches out from the center with a 5$\frac{15}{16}$-inch end stub. To achieve an swr which met Willie's approval (1.03 to 1), pieces as short as $\frac{1}{16}$ inch had to be moved from the stub end to the opposite end. These pieces were later replaced with a single piece firmly attached by means of an inside sleeve pinned in place.

Obviously, the feedpoint gap had to be covered somehow, desirably with some rigid insulating sleeve that would support the end stub. Here I was able to come up with a solution. A machinist friend made me a Teflon sleeve approximately 3 inches long, 1 inch in diameter, and bored out to be a press fit onto the $\frac{3}{8}$-inch driven element. Properly greased with DC-4, this sleeve was forced into place. As a final touch, Willie had two pretty red plastic caps that perfectly fit the ends of the driven element. Since this was to be a vertically polarized antenna (with the feed gap being on top), a hole was bored through the bottom cap to allow moisture to escape.

The performance of this antenna was exceptional. When fed with 20 feet of coax, the swr was less than 2 to 1 over a frequency range of 145 to 148.4 MHz, and less than 1.5 to 1 from 146 to 147.9 MHz (see Fig. 3). This matching method should be very efficient (minimum connections), and it should be less susceptible to moisture since there are no reactive tuning components.

I could hardly wait to get this Willie Wand Special antenna mounted on top of my house and hooked up to my rig. Willie kept prodding me, of course, asking me every day "When are you going to get that antenna up?" As quickly as possible, therefore, I acquired a rotator, roof-mount tower, insulated mast (1$\frac{1}{4}$-inch fiberglass tubing), rotator cable, and coax cable. Starting early one Saturday morning, I really got with it. By late afternoon, I had it all up and went into the house to give it a try. I just got through hooking it up to the rig and was trying out the rotator when the doorbell rang. Of course, there stood Willie with his head tilted back, admiring his Willie Wand Special.

This antenna has proved to be every bit as good as Willie predicted. If anyone wants to copy it, however, be prepared to go through a similar adjustment procedure. You will, however, have the benefit of Willie's experience, starting with the feedpoint about 11$\frac{3}{4}$ inches from the center (for a 147-MHz center frequency). See Table 1 for material and dimensional specifications.

Willie has since assembled a second version of this antenna for another of his SS net buddies, George W5KQD. As expected, it is not constructed exactly the same, the driven element being built out of $\frac{3}{8}$-inch thin-wall copper pipe. The dimensions did, however, come out to be very similar to mine.

The coax and coax fitting on George's antenna also are different, the coax being RG-115 (about the size of RG-8), and the coax fitting constructed out of a pipe-to-copper-tubing adaptor (again milled into shape by the vertical mill). Since this adaptor was brass, the coax shield was soldered directly to it, and the complete fitting was soldered to the driven element. A similar brass insert and Teflon washer were used to insulate and attach the coax center conductor to the outer stub. Again, a Teflon sleeve was used to insulate and add rigidity to the feedpoint gap.

If you happen to be within a 40-mile radius of Tulsa between the hours of 8 and 10 am, give a listen on 146.46 simplex. No doubt you will hear a strong signal being radiated from a Willie Wand Special. ■

BARTER 'N' BUY

Individual (noncommercial) .... 25¢ per word
Commercial .... 60¢ per word

Prepayment by check or money order is required with your ad. No discounts or commissions are available. Please make your payment to *73*. Rates for multiple insertions are available on request.

Advertising must pertain to amateur radio products or services. No special layouts or positions are possible. All advertising copy must be submitted typewritten (double-spaced) and must include full name and address. Copy limited to 100 words, maximum. Count only words in text. Address, free.

73 cannot verify advertising claims and cannot be held responsible for claims made by the advertiser. Liability will be limited to making any necessary corrections in the next available issue.

Copy must be received in Peterborough by the 5th of the second month preceding the cover date.

Make checks payable to *73* Magazine and send to: Jim Gray, Advertising Department, *73* Magazine, 80 Pine St., Peterborough NH 03458.

MOBILE IGNITION SHIELDING. Free literature. Estes Engineering, 930 Marine Drive, Port Angeles WA 98362. BNB006

MILITARY TECHNICAL MANUALS for old and obsolete equipment. 60-page catalog, $3.00. Military Technical Manual Service, 2266 Senasac Ave., Long Beach CA 90815. BNB045

HAM RADIO REPAIR, tube through solid state. Robert Hall Electronics, PO Box 8363, San Francisco CA 94128; (408)-729-8200. BNB219

QSLS to order. Variety of styles, colors, card stock. W4BPD QSLs, PO Drawer DX, Cordova SC 29039. BNB260

THE DX'ERS MAGAZINE. Up-to-date, informative, interesting. Compiled and edited by Gus Browning W4BPD, DXCC Honor Roll Certificate 2-4. Send for *free* sample and subscription information today. PO Drawer DX, Cordova SC 29039. BNB261

COCO OWNERS—Free software and hardware brochure. CoCoNuts, POB 9866, San Jose CA 95157-0866. BNB265

CASH PAID for traffic/speed radar equipment. Write or call: Brian R. Esterman, PO Box 8141, Northfield IL 60093; (312)-251-8901. BNB271

INDIVIDUAL PHOTOFACT FOLDERS: #1 to #1400, $3.00 postpaid. AJL, 414 Chestnut Lane, East Meadow NY 11554. BNB312

IMRA—International Mission Radio Association. Forty countries, 800 members. Assists missionaries with equipment loaned, weekday net. 14.280 MHz, 2:00-3:00 pm Eastern. Brother Bernard Frey, 1 Pryer Manor Road, Larchmont NY 10538. BNB326

ELECTRON TUBES: receiving, transmitting, microwave all types available. Large inventory means next-day shipment in most cases. Daily Electronics, PO Box 5029, Compton CA 90224; (213)-774-1255. BNB330

WANTED: radios, tubes pre-1939 for my collection. Howard Stone, HCR-3, Box 418, Deer River MN 56636. BNB332

HAM TRADER YELLOW SHEETS, in our 24th year. Buy, swap, sell ham-radio gear. Published twice a month. Ads quickly circulate—no long wait for results. SASE for sample copy. $10.00 for one year (24 issues). PO Box 356, Wheaton IL 60189. BNB335

RADIO TRANSCRIPTION DISCS WANTED. Any size, speed. W7FIZ, Box 724—WG, Redmond WA 98073-0724. BNB347

FIND OUT what else you can hear on your general-coverage transceiver or receiver. Join a shortwave radio listening club. Complete information on major North American clubs and sample newsletter, $1.00. Association of North American Radio Clubs, 1500 Bunbury Drive, Whittier CA 90601. BNB310

CABLE CONVERTERS. Lowest price. Dealer inquiries accepted. Quantity discounts. Free catalog. P.G. Video Corp., 61 Gatchell St., Dept. 73, Buffalo NY 14212. BNB349

KT5B ANTENNA, 160m-10m, no traps, $59.95. Weather-boot kit, $8.95. Open-wire feedline, roller inductors, antenna accessories, and much more! Kilo-Tec, PO Box 1001, Oak View CA 93022; (805)-646-9645. BNB360

ROHN TOWERS—wholesale direct to users. *23% to 34% discount from dealer* price. All products available. Write or call for price list. Also we are wholesale distributor for Heliax antenna cable. Hill Radio, 2503 G E Road, PO Box 1405, Bloomington IL 61701-1405; (309)-663-2141. BNB366

HI-MOUND keying mechanisms now available! Finest and most extensive line of hand keys, mobile keys and iambic paddles. Write for free catalog. Skywave Radio Systems Box Q-1, 943 Boblett, Blaine WA 98230. BNB378

TR-7 USERS—NB-7 noise blanker, new, $65 ppd. SL-300 CW filter, new, $50 ppd. HS-75 headset by Drake, new, $14 ppd. Tony Musero K3UKW, (215)-271-8898. BNB380

CABLE TV CONVERTERS and equipment. Plans and parts. Build or buy. Free information. C & D Electronics, 626 Flowerdale, Dept. 73, Ferndale MI 48220. BNB383

QSL CARDS: 100 for $5.00, 500 for $18.00. For a sample, send an SASE to Ken Hand WB2EUF, PO Box 708, East Hampton NY 11937. BNB388

DX HEADING MAPS for Boston, New York City, Philadelphia, Baltimore, Detroit, Atlanta, Chicago, New Orleans, St. Louis, Dallas, and Los Angeles. 11" × 17", $3.75 ppd. Specify city. Bill Massey W2HOJ, PO Box 417, Hainesport NJ 08036. BNB392

FREE: 60-page electronic/computer parts catalog. Hosfelt Electronics, 2610 Sunset, Steubenville OH 43952; (614)-264-6464. BNB393

NEW! CW WORD-COPYING COURSE! Complete. Easy-to-learn. QSO-Trainer™ Code Course. Includes two 60-minute audio cassettes and complete instructions. Send $16.95 (Indiana residents add $0.85). Money-back, satisfaction guarantee (less $2.00 shipping and handling). Business-size SASE gets free information. AVC Innovations, Inc., Department 7C3, PO Box 20491, Indianapolis IN 46220-0491. BNB394

BLACK DACRON® POLYESTER ROPE. Send us your name, address, call letters, and $1.00 and we'll send you samples of our new easy-knotting, easy-cutting, UV-protected, highly abrasion resistant 3/16" rope and all necessary ordering information. $1.00 credit on your first order! Synthetic Textiles, Inc., 2472 Eastman Avenue, Building 21-22, Ventura CA 93003; (805)-658-7903. BNB395

KENWOOD 430S OWNERS! Stop 430S scanner on busy frequencies. When clear, resume automatically! Squelch-activated! Reviewed *QST* 6/85, *73* 2/85, *Worldradio* 12/84. $19.95; $29.95 assembled. $2.50 shipping. JABCO Stop Scan, R1 Box 386, Alexandria IN 46001. BNB396

SSB SQUELCH for any radio! Improved circuitry! Active filters! 2½" × 5½". $54.95 plus $2.50 shipping. JABCO Squelch-It, R1 Box 386, Alexandria IN 46001. BNB397

SOLAR-ELECTRIC MODULES. Dealer price list, $1.00. Homestead Distributing, PO Box 451, Northport WA 99157; (509)-732-6142. BNB398

SURPLUS AND MORE SURPLUS. Thousands of items, free bargain-packed flyers. ETCO Electronics, Plattsburgh NY 12901. BNB399

BUILD A COMPUTER-AIDED-DESIGNED 6-dB stacked vertical omnidirectional 2-meter antenna for less than $50.00 using hardware-store materials. Send $5.00 for detailed plans and parts list. John De Armond WD4OQC, PO Box 3657, Cleveland TN 37311. BNB400

BURGLAR ALARMS . . .300 plus wholesale sources. Introduction to security alarm business. Terrific business/employment opportunities. Get in now. Information $2.00. Security Electronics International, PO Box 1456-J, Grand Rapids MI 49501. BNB401

WANTED: a copy of a service manual or schematic for an SBE SB 450 UHF transceiver. I will pay costs. Steven L. Delay N9EEM, RR1, Pawnee IL 62558; 522-6391 days. BNB402

ANTIQUE RADIOS, schematics, tubes, and literature. For a large catalog, send $1.00 to VRS(ST), 376 Cilley Road, Manchester NH 03103. BNB403

1985 INDEX

ARTICLE	AUTHOR	DESCRIPTION	ISSUE	
Amplifiers				
Home-Brew the Blockbuster	WB2WIK	2-kW 6-meter linear	Jul	50
Satellite Supremacy	W2GEF	60-Watt UHF amplifier	Feb	18
That Glorious Gonset	KT2B	rebuild a Gonset 972	Jan	34
Antennas				
A Gentleman's Antenna	WA4BLC	super-short 160m wire	Nov	44
A New Angle for Dipoles	W1GV	the case for vertical dipoles	Sep	54
A Space-Saver Seven Megger	WBTYX	full-wave 40m loop	Jan	44
Again, the CCD	KC8BN/7	more on an amazing antenna	Aug	12
Alligatored Antennas	WOMBP	new bands for old antennas	May	50
America's Dream Array	AJON	National Radio Astronomy Observatory	Jul	18
Brew a Coffee Ground Plane	WA2OVG	easy 440-MHz antenna	Sep	30
Build the Broadband Bow Tie	WD9ELG	80m wonder	Sep	38
Discover the Discone	W1GV	HF multiband cage	May	17
Don the Dayton Hat-tenna	WB3CQA	2m duck on your hat	Apr	26
Don't Fall for Swr Fraud	W1GV	check your feedline	Sep	40
Dr. Frankenstein's CB Beam	KA3JOM	CB beam remade for 10m	Sep	62
Exponential Potential	W6TYH	exponential line matching	Sep	44
Fighting Fire With Wire	W6TYH	15m V-bomb array	Sep	26
Ollie's Folly	W1ZB	build an HF helix	Feb	42
Phase the Nation	KB2XX	trapped vertical array	May	54
Porcupine Mobile	N2CMU	triband mobile mag-mount	May	40
Rotate the Bobtail Curtain	WBHXR	phase-shift your pattern	May	48
Saga of the Willie Wand	W5RRH	6-element 2m beam	Dec	52
Six for Two	KA8RCJ	6-element 2m delta loop	Sep	58
So Why Do They Call It Wireless?	WA8JXE	5-band antenna	Mar	45
Swr: A Modern Myth?	W6YUY	improve your antenna system	Feb	32
The No-Baloney Lunchbox	KR3T	low-tech antenna tuner	May	44
The Rubber Duck Debunked	W4NVK	10 dB gain over a duck	May	42
Two for Two	WA4BLC	pair of 2m antennas	May	22
Up, Up, and Array	W6TYH	hybrid HF collinear	May	32
Where Am I Pointed?	AD1B	Sinclair beam-aimer	May	56
Whip the Competition	N3DRW	2m "Datsun" whip	Sep	42
Zuper Zepp for VHF	WA4UZM	simple extended zepp	May	52
Construction				
A Gentleman's Antenna	WA4BLC	super-short 160m wire	Nov	44
A New Angle for Dipoles	W1GV	the case for vertical dipoles	Sep	54
A Scavenger's Radio	KA0DMT	extremely simple receiver	Aug	66
A Space-Saver Seven Megger	WBTYX	full-wave 40m loop	Jan	44
AFSK, And Ye Shall Transceive	K9EUI	stable AFSK generator	Jun	32
Again, the CCD	KC8BN/7	more on an amazing antenna	Aug	12
Automate the FT-757	KA6IPQ	control your Yaesu with an MC-10	Jan	30
Brew a Coffee Ground Plane	WA2OVG	easy 440-MHz antenna	Sep	30
Build a 1296 Stripper	WB6IGP	ATV downconverter	Oct	40
Build a Better Box	W4RNL	how-to project enclosures	Feb	44
Build the Broadband Bow Tie	WD9ELG	80m wonder	Sep	38
Build the Dixie Whistler	WB5IPM	two-tone SSB tester	Apr	36
Conjure An Rf Genie	K1BQT	simple signal generator	Nov	32
Discover the Discone	W1GV	HF multiband cage	May	17
Don the Dayton Hat-tenna	WB3CQA	2m duck on your hat	Apr	26
Dr. Frankenstein's CB Beam	KA3JOM	CB beam remade for 10m	Sep	62
Exponential Potential	W6TYH	exponential line matching	Sep	44
Fighting Fire With Wire	W6TYH	15m V-bomb array	Sep	26
Harmonic-Free QRP?	ZS6UP	measure harmonic power	Aug	29
Hear, Hear!	W6IOJ	OSCAR downlink preamp	Apr	20
Home-Brew the Blockbuster	WB2WIK	2-kW 6-meter linear	Jul	50
How Good Is Six?	KL7GLK	home-brew 6-meter rig	Jan	57
Instant ATV!	W8CHK	plug-in fast-scan TV	Aug	36
Is Your Repeater Dying?	WA4TEM	16-channel telemetry encoder	Jan	50
Ollie's Folly	W1ZB	build an HF helix	Feb	42
One-Chip Facsimile	WB8TPD	Atari system	Dec	38
Operate OSCAR on 10 Meters?	W6IOJ	145/435-MHz converter	Nov	36
Perfection Plus	W1PDI	improved RTTY tuning	Jun	36
Phase the Nation	KB2XX	trapped vertical array	May	54
Porcupine Mobile	N2CMU	triband mobile mag-mount	May	40
Probe the Unknown	Bailey	no-load active rf probe	Nov	46
Saga of the Willie Wand	W5RRH	6-element 2m beam	Dec	52
Satellite Supremacy	W2GEF	60-Watt UHF amplifier	Feb	18
Scope That Signal	KD6VP	home-brew station monitor	Aug	56
Shoestring RTTY	W9ODK	inexpensive terminal unit	Jan	46
Six for Two	KA8RCJ	6-element 2m delta loop	Sep	58
Slick VIC Trick	KW9L	cheap printer add-on	Jun	50
So Why Do They Call It Wireless?	WA8JXE	5-band antenna	Mar	45
Speech! Speech!	WA4TEM	talking repeater controller	Mar	38
Take a Hike	N3BEK	smart mobile power	Apr	54
Talk Is Cheap	WB6NQK	affordable voice synthesis	Oct	22
The 30-Meter-Plus Receiver	N4EY	home-brew 10-MHz receiver	Jul	30
The Downunda Project: Part I	Simpson	Dick Smith 2m transceiver	Aug	14
The Downunda Project: Part II	Simpson	assembly and alignment	Sep	17
The Incredible Digiohm	Rich	the ultimate resistance box	Mar	34
The Incredible Inducto-Gauge	Ketchledge	coil measurer	Jul	34
The No-Baloney Lunchbox	KR3T	low-tech antenna tuner	May	44
The Peerless Power Pack	KO2G	12-volt 5-Amp supply	Jul	38
The Rubber Duck Debunked	W4NVK	10 dB gain over a duck	May	42
The Texas Trans-Tester	KG5B	small-gain transistor checker	Feb	60
There and Back Again	KC7O	band-scan for the TS-930S	Jul	44
Toss Out Your Tubes!	OA4KO	use FETs instead	Nov	22
Tune In the TU-1000	K9EUI	low-budget RTTY modem	Jun	14
Two for Two	WA4BLC	pair of 2m antennas	May	22
Up, Up, and Array	W6TYH	hybrid HF collinear	May	32
VIC RAMification: Part I	Brefini	add 24K RAM to your VIC-20	Jan	18
VIC RAMification: Part II	W6LOB	add 3K RAM to your VIC-20	Jan	22
What You See Is Where You're At	WA8YKN	add-on digital frequency display	Jul	40
Wheatstones Are Not Crackers!	K4KI	Muller Bridge for swr woes	Sep	50
Whip the Competition	N3DRW	2m "Datsun" whip	Sep	42
World War Wireless	W1BG	build a foxhole radio	Aug	32
Zuper Zepp for VHF	WA4UZM	simple extended zepp	May	52
CW				
All This and PCII!	W4FXI	Morse keyboard for the PCII	Mar	26
Cheap Heath Help	K6YB	HW-101 transmit offset	Mar	48
Super Surplus Surprise	K9RLF	rejuvenate the GRC-9	Feb	54
Gadgets				
Hunt the Auto-Fox	WB6GTM	automatic fox identifier	Aug	48
Is Your Repeater Dying?	WA4TEM	16-channel telemetry encoder	Jan	50
NOAA's 2m UFO	K9POX	weather-radio signal source	Dec	42
Perfection Plus	W1PDI	improved RTTY tuning	Jun	36
Talk Is Cheap	WB6NQK	affordable voice synthesis	Oct	22
What You See Is Where You're At	WA8YKN	add-on digital frequency display	Jul	40
World War Wireless	W1BG	build a foxhole radio	Aug	32
I/O				
All This and PCII!	W4FXI	Morse keyboard for the PCII	Mar	26
Automate the FT-757	KA6IPQ	control your Yaesu with an MC-10	Jan	30
CoCo's Counter	KG4Q	software frequency counter	Jun	26
Convert and Converse	WB9AOU	transmit C-64 files with Hamtext	Nov	52
Give Your Disks a Physical	Kraska	quality-inspection tips	Oct	56
One-Chip Facsimile	WB8TPD	Atari system	Dec	38
Slick VIC Trick	KW9L	cheap printer add-on	Jun	50
Speak-No-Evil RTTY	WA6NHC	Heath H-8 terminal program	Jun	40
Through the Looking Glass	KN4L	software RTTY monitor	Jun	34
VIC RAMification: Part I	Brefini	add 24K RAM to your VIC-20	Jan	18
VIC RAMification: Part II	W6LOB	add 3K RAM to your VIC-20	Jan	22
Where Am I Pointed?	AD1B	Sinclair beam-aimer	May	56
Miscellaneous				
A Scavenger's Radio	KA0DMT	extremely simple receiver	Aug	66
Above Intercept	Layton	British WWII secret radio	Oct	36
America's Dream Array	AJON	National Radio Astronomy Observatory	Jul	18
Dateline: Dayton	WA4BPI	Hamvention preview	Apr	12
Do Volunteer Examiners Work?	W5YI	discussion by national VEC	Mar	28
Future Schlock	KA5S	experiments in time	Feb	30
Good to the Last Dot	N6HYK	practical communication tips	May	38
In Search Of: RTTY	WA0MRG	RTTY beyond the band edge	Apr	48
Is Ham Radio Baking Us?	VE3KSP	dangers of rf exposure	Jun	28
Ishmod's Journal	Whipple	the story continues	Apr	24
It's a Dangerous Obsession	KB4YI	growing up with electronics	Nov	50
Join the SWOT Team!	KA3B	alternate 2m activities	Dec	26
Just Leave Me Here To Die!	KT2B	UHF contesting at 4200 feet	Nov	14
Looking East	WA6ITF	25 years of fun	Oct	46
NOAA's 2m UFO	K9POX	weather-radio signal source	Dec	42
Old Tubes Never Die!	W6HDM	the romance of antique tubes	Oct	50
QRI?	W2OZH	replacement for RST	Nov	28
Secrets of Cellular Radio	N1BLH	behind-the-scenes tour	Dec	44
Secrets of Telehamming	K9EI	accessing computer services	Jun	24
Silver Eagle Awards	Staff	73's 25th anniversary awards	Oct	18
Surviving the Unthinkable: Part III	WA8YKN	EMP precautions	Aug	52
Takin' It to the Streets: Part I	WA6AXX	ShackMaster introduction	Sep	32
Takin' It to the Streets: Part II	WA6AXX	using the ACC ShackMaster	Oct	32
Talk Is Cheap	WB6NQK	affordable voice synthesis	Oct	22
The Snake with LED Eyes	WA8WTE	tall tale from the Antlers	May	24
TVRO Trivia	W6SMJ	satellite-television primer	Mar	14
Mobile/Portable				
Don the Dayton Hat-tenna	WB3CQA	2m duck on your hat	Apr	26
Secrets of Cellular Radio	N1BLH	behind-the-scenes tour	Dec	44
Take a Hike	N3BEK	smart mobile power	Apr	54
The Downunda Project: Part I	Simpson	Dick Smith 2m transceiver	Aug	14
The Downunda Project: Part II	Simpson	assembly and alignment	Sep	17
Modifications				
Alligatored Antennas	WOMBP	new bands for old antennas	May	50
Broken Ox Blues	W7RXV	new coils for your gdo	Jul	56
CB to Six	DA1GY	Hy-Gain CB on 50 MHz	Feb	22
Cheap Heath Help	K6YB	HW-101 transmit offset	Mar	48
Eight Mods for the IC-730	N6HI	quick ICOM improvements	Jan	10
FM Your IC-730	N9DBX	quick add-on	Dec	18
ICOM's Extended Play	KS4B	full .1 to 30 MHz transmit	Jul	12
Instant ATV!	W8CHK	plug-in fast-scan TV	Aug	36
Modification Mania!	AI7C	15 HW-101 perk-ups	Aug	42
NOAA's 2m UFO	K9POX	weather-radio signal source	Dec	42
On the Flip Side	K1QPS	Interface II reverse shift	Jun	42
Perfection Plus	W1PDI	improved RTTY tuning	Jun	36
QSK for Your Vintage Vfo	KA3GCQ	easy break-in keying	Jun	54
Quash QRM	KA4MTO	TS-520 RTTY receive mod	Jun	44
Rotate the Bobtail Curtain	WBHXR	phase-shift your pattern	May	48
Super Surplus Surprise	K9RLF	rejuvenate the GRC-9	Feb	54
The D-Day Demodulator	WB5LLM	revive the CV-89A	Jun	46
The Santec Spectacular	W2IVS	two simple mods	Dec	50
There and Back Again	KC7O	band-scan for the TS-930S	Jul	44
Toss Out Your Tubes!	OA4KO	use FETs instead	Nov	22
WARC for the FT-101E	ZS2RH	18 and 24 MHz mod	Jul	22
New Products				
A.P.E.		PRS-475PG PCB repair system	Aug	68
Ace Communications		AR-33 VHF FM monitor	Jan	82
Adtech		4KS-150-IBM power supply	Mar	72
Adtech		CS-1307 switching supply	Jul	68
AEA		ATU-1000	Sep	75
AEA		PK-64 TNC	Dec	72
Alpha Delta		DX-A twin-sloper antenna	Sep	74
Amateur Wholesale Electronics		Theta-777	May	82
American Soldering Devices		MG-1400 soldering gun	Sep	75
Antenna Specialists		ASA-3102-25	Dec	72
Antenna Specialists		rf power amplifiers	Mar	73
Antenna Specialists		cellular antenna	Sep	74
Antenna Specialists		wall chart	May	83
Associated Technology		software author's manual	Mar	72
Ava Electronics		rf connector catalog	Aug	69
BaileyTech		Opti-Phasor	Nov	76
Bel-Tek		CMOS keyer	Oct	77
Bird Electronics		50-Ohm connector kit	Dec	72
BMI, Inc.		Nitelogger	Jul	68
BV Engineering		Locipro software	Sep	74
CaGen Software		Contest Log	Apr	69
Centurion		Ear Com	Oct	76
Cetec Vega		DTMF/RS-232C modem	Apr	70
CMC Communications		AR-200XL rotor	May	83
CMC Communications		Docking Booster	Sep	74
Com-Rad		Untenna	May	82
Communications Specialists		RB-1 reverse-burst board	Feb	69
Communications Specialists		TP-38 repeater tone panel	Dec	73
Communications Specialists		TR-720 accessory catalog	Aug	68
Comperstuff		RBBS/64 mailbox software	Mar	72
Computerware		inventory system software	Mar	72
Contact East		free tool catalog	Jul	68
Cushcraft		catalog	Jun	66
Cushman		CE-6488 radio analyzer	Jan	82
dataLOG Software		Amateur Radio Logbook	Feb	68

Davie Tech	PCBH-50 work station	Jul	68
Deiaenroth	battery exerciser	Mar	73
Di$count America	buying guide	Feb	68
Electronic Specialists	catalog	May	83
Electronic Specialists	Kleen Line PDS-21	Sep	74
ESCI	PLL frequency synthesizer	Apr	70
Everett/Charles	F353-FD disk drive	Mar	72
GLB	PK1L TNC	Dec	73
Gripmate Enterprises	Gripmate	Dec	72
Hal Communications	SPT-1 Spectra-Tune	May	82
Hamtronics	CVR-900 scanner converter	Aug	69
Hamtronics	digital FSK modules	Jun	66
Hamtronics	LNG-800 UHF preamp	Apr	71
Hamtronics	PPA-220 packet amp	Sep	75
Heathkit	HD-4040 TNC	Sep	75
Heathkit	SA-2500 auto antenna tuner	Jan	82
Heathkit	Smart Outlet	Dec	73
Heathkit	Z-22 monochrome terminal	Apr	70
Help Technologies	HelpDOS	Jun	65
Hildreth Engineering	Super CW Audio Filter	Jul	68
ICOM	IC-1271A	Nov	76
ICOM	IC-3200A	May	82
ICOM	IC-735	Jun	65
ICOM	IC-A2 air-band HT	Aug	69
ICOM	IC-R7000	Oct	76
International Radio	ICOM/Kenwood crystal filter	Feb	69
International Radio	TS-940S crystal filter	Aug	68
Jensen Tools	JTK-76 tool kit	May	82
Jensen Tools	LogicScope	Aug	69
Jensen Tools	Octopus troubleshooter	Jul	69
Kantronics	Packet Communicator	Jun	66
Kaul-Tronics	TVRO antenna	Mar	73
Kenwood	TH-series accessories	Dec	73
Kilo-Tec	weather boots	Jul	69
Larsen	dual-band mobile antennas	Sep	74
Larsen	KD-14-450-HW	May	82
Louis and Beech	Tic-Tracer	Nov	76
Luxor	9726 block downconverter	Aug	68
MFJ	MFJ-204 antenna bridge	Feb	69
MFJ	MFJ-818 swr/wattmeter	Nov	76
Midian Electronics	DTCS-1 and BTD-1	Dec	72
Midian Electronics	communications encoders	Feb	68
Midland	desktop repeater	Nov	76
Midland	portable UHF radio	Sep	74
Mountain West	Photo Trap security system	Aug	68
Nemal	ST-1 actuator cable	Feb	69
Newsome Electronics	C-64/VIC-20 software	Feb	69
Non-Linear Systems	AP-105 digital multimeter	Apr	70
P.C. Electronics	TC70-1 ATV transceiver	Jun	65
Protectall Corp.	Compu-Fire extinguisher	Jul	69
Radio School	Complete Novice	Oct	77
Rapid Systems	digital oscilloscope	Apr	71
Regency	Z60 scanner	Nov	76
S-Com	MRC-100 repeater controller	Dec	73
Santec	ST-200ET/ST-400ET	May	84
SMMI Products	flexible illuminator	Jun	65
Sultronics	HF Sloper antenna	Sep	75
Syntest	SI-160 synthesizer	Feb	68
Texas Instruments	reference books	Dec	72
Triplett	Model 4700 multimeter	Jun	66
Twin Oaks Associates	C.W. Tutorsoft	Feb	69
Twin Oaks Associates	Amateur Testcalm	Dec	72
Ultima Electronics	UL-100 battery charger	Apr	70
Universal Electronics	satellite television book	Feb	68
Visualtek, Inc.	Braille Display Processor	Jul	68
VoCom	VHF/UHF amplifiers	Apr	71
Wahl Clipper	desoldering tool	Nov	76
Wahl Clipper	Iso-Tip drill	Aug	68
Wels	wattmeters	Jun	66
West's Radio School	amateur test guides	Mar	72
Winner's Edge	Contester	Oct	77
Wintek	smARTWORK pcb designer	Jun	65

Power Supplies

Take a Hike	N3BEK	smart mobile power	Apr	54
The Peerless Power Pack	KO2G	12-volt 5-Amp supply	Jul	38

Receivers

A Scavenger's Radio	KA0DMT	extremely simple receiver	Aug	66
America's Dream Array	AJ0N	National Radio Astronomy Observatory	Jul	18
Build a 1296 Stripper	WB6IGP	ATV downconverter	Oct	40
FM Your IC-730	N9DBX	quick add-on	Dec	18
Future Schlock	KA5S	experiments in time	Feb	30
Hear, Hear!	W6IOJ	OSCAR downlink preamp	Apr	20
Modification Mania!	AI7C	15 HW-101 perk-ups	Aug	42
One-Chip Facsimile	WB8TPD	Atari system	Dec	38
Operate OSCAR on 10 Meters?	W6IOJ	145/435-MHz converter	Nov	36
Quash QRM	KA4MTO	TS-520 RTTY receive mod	Jun	44
The 30-Meter-Plus Receiver	N4EY	home-brew 10-MHz receiver	Jul	30
The Dayton Downlink	W9JD/8	optimizing your OSCAR setup	Jul	24
TVRO Trivia	W6SMJ	satellite-television primer	Mar	14
World War Wireless	W1BG	build a foxhole radio	Aug	32

Repeaters

Don the Dayton Hat-tenna	WB3CQA	2m duck on your hat	Apr	26
Hunt the Auto-Fox	WB6GTM	automatic fox identifier	Aug	48
Is Your Repeater Dying?	WA4TEM	16-channel telemetry encoder	Jan	50
Join the SMOT Team!	KA3B	alternate 2m activities	Dec	26
Saga of the Willie Wand	W5RRH	6-element 2m beam	Dec	52
Speech! Speech!	WA4TEM	talking repeater controller	Mar	38
Takin' It to the Streets: Part I	WA6AXX	ShackMaster introduction	Sep	32
Takin' It to the Streets: Part II	WA6AXX	using the ACC ShackMaster	Oct	32
The Downunda Project: Part I	Simpson	Dick Smith 2m transceiver	Aug	14
The Downunda Project: Part II	Simpson	assembly and alignment	Sep	17
The Rubber Duck Debunked	W4NVK	10 dB gain over a duck	May	42
The Santec Spectacular	W2IVS	two simple mods	Dec	50
Whip the Competition	N3DRW	2m "Datsun" whip	Sep	42

Reviews

AEA	W1XU	MicroAMTOR Patch	Mar	62
AEA	K9EI	PKT-1	Jun	66
AEA	W1XU	TI-1 RTTY tuning indicator	Jan	67
Bilal	W1XU	Isotron 20	Sep	76
CaGen	K9EI	Contest Log	Jun	68
CES	N1BLH	510SA Smart Patch	Jul	78
ColAtchCo	K1VB	40-m InstArray	May	69
Dick Smith Electronics	KT2B	K-6312 UHF wattmeter	Aug	71
Flesher	KB3T	TU-1200	Apr	65
Fox Tango	K9EI	Mini Jini software	Jan	67
GLB	KW1O	PK-1 TNC	Dec	70
Hal Communications	KW1O	CWR6850	Jul	78
Ham Data	K9EI	Super Log IV	Apr	66
HAMLOG	K9EI	Commodore logging software	Jul	79
Hayden Books	K9EI	Computer Programs for Amateur Radio	May	68
Heathkit	K3NGQ	SW-7800 receiver	Aug	70
Hy-Gain	N1BLH	2058-S	Dec	69
ICOM	N1BLH	IC-735	Nov	80
Kantronics	K9EI	Packet Communicator	Oct	67
Kenwood	WA4BLC	TH-21A	Mar	60
Kenwood	N1BLH	TR-2600A	Jun	67
Kenwood	KC9IY	TS-430S	Feb	70
MFJ	W1XU	MFJ-1621 portable antenna	Sep	76
MFJ	W1XU	MFJ-204 antenna noise bridge	Sep	76
Regency	N3BAH	HX1000 scanner	Jan	66
Seiko	KR3T	Data-2000	Aug	71
Sonnet Software	K9EI	Mail-Order Annie	Sep	77
SSB Electronics	KT2B	LT23S transverter	Dec	71
Tesla Book Company	W1XU	Solutions to Tesla's Secrets	Feb	71
TET	KA3JOM	HB-443DX	May	68
Universal Electronics	KW1O	Hidden Signals on Satellite TV	Mar	61
vicCOMM	K9EI	H-31 SSTV/Commodore interface	Feb	70
Vid-Com	K9EI	VIC MSO	Mar	60
W9INN Antennas	AD1B	Space Saver Dipole	May	68
Welz	KR3T	SP-45M swr/power meter	Feb	70
Yaesu	N1BLH	FT-780R	Oct	67

RTTY

AFSK, And Ye Shall Transceive	K9EUI	stable AFSK generator	Jun	32
CoCo's Counter	KG4Q	software frequency counter	Jun	26
In Search Of: RTTY	WA0MRG	RTTY beyond the band edge	Apr	48
On the Flip Side	K1QPS	Interface II reverse shift	Jun	42
Perfection Plus	W1PDI	improved RTTY tuning	Jun	36
Quash QRM	KA4MTO	TS-520 RTTY receive mod	Jun	44
Secrets of Telehamming	K9EI	accessing computer services	Jun	24
Shoestring RTTY	W9ODK	inexpensive terminal unit	Jan	46
Speak-No-Evil RTTY	WA6NHC	Heath H-8 terminal program	Jun	40
The D-Day Demodulator	WB5LLM	revive the CV-89A	Jun	
Through the Looking Glass	KN4L	software RTTY monitor	Jun	34
Tune In the TU-1000	K9EUI	low-budget RTTY modem	Jun	14

Test Equipment

Broken Ox Blues	W7RXV	new coils for your gdo	Jul	56
Build the Dixie Whistler	WB5IPM	two-tone SSB tester	Apr	36
Conjure An Rf Genie	K1BQT	simple signal generator	Nov	32
Harmonic-Free QRP?	ZS6UP	measure harmonic power	Aug	29
Probe the Unknown	Bailey	no-load active rf probe	Nov	46
Scope That Signal	KD6VP	home-brew station monitor	Aug	56
The Incredible Digiohm	Rich	the ultimate resistance box	Mar	34
The Incredible Inducto-Gauge	Ketchledge	coil measurer	Jul	34
The Texas Trans-Tester	KG5B	small-gain transistor checker	Feb	60
Through the Looking Glass	KN4L	software RTTY monitor	Jun	34
What You See Is Where You're At	WA8YKN	add-on digital frequency display	Jul	40
Wheatstones Are Not Crackers!	K4KI	Nuller Bridge for swr woes	Sep	50

Theory

A New Angle for Dipoles	W1GV	the case for vertical dipoles	Sep	54
Build a Better Box	W4RNL	how-to project enclosures	Feb	44
Don't Fall for Swr Fraud	W1GV	check your feedline	Sep	40
Exponential Potential	W6TYH	exponential line matching	Sep	44
Future Schlock	KA5S	experiments in time	Feb	30
Give Your Disks a Physical	Kraska	quality-inspection tips	Oct	56
Harmonic-Free QRP?	ZS6UP	measure harmonic power	Aug	29
Is Ham Radio Baking Us?	VE3KSP	dangers of rf exposure	Jun	28
QRI?	W2OZH	replacement for RST	Nov	28
Secrets of Cellular Radio	N1BLH	behind-the-scenes tour	Dec	44
Surviving the Unthinkable: Part III	WA8YKN	EMP precautions	Aug	52
Swr: A Modern Myth?	W6YUY	improve your antenna system	Feb	32
Takin' It to the Streets: Part I	WA6AXX	ShackMaster introduction	Sep	32
Takin' It to the Streets: Part II	WA6AXX	using the ACC ShackMaster	Oct	32
Talk Is Cheap	WB6NOK	affordable voice synthesis	Oct	22
Toss Out Your Tubes!	OA4KO	use FETs instead	Nov	22
Transistors: A Biased Approach	KC0EW	transistor design tutoria	Jan	26
TVRO Trivia	W6SMJ	satellite-television primer	Mar	14
Wheatstones Are Not Crackers!	K4KI	Nuller Bridge for swr woes	Sep	50
Zounds! Grounds!	K4IPV	install the perfect ground	Apr	30

Transmitters

Build the Dixie Whistler	WB5IPM	two-tone SSB tester	Apr	36
Cheap Heath Help	K6YB	HW-101 transmit offset	Mar	48
FM Your IC-730	N9DBX	quick add-on	Dec	18
Home-Brew the Blockbuster	WB2WIK	2-kW 6-meter linear	Jul	50
ICOM's Extended Play	KS4B	full .1 to 30 MHz transmit	Jul	12
Instant ATV!	W8CHK	plug-in fast-scan TV	Aug	36
Modification Mania!	AI7C	15 HW-101 perk-ups	Aug	42
Operate OSCAR on 10 Meters?	W6IOJ	145/435-MHz converter	Nov	36
QSK for Your Vintage Vfo	KA3GCQ	easy break-in keying	Jun	54
Satellite Supremacy	W2GEP	60-Watt UHF amplifier	Feb	18
Super Surplus Surprise	K9RLF	rejuvenate the GRC-9	Feb	54
That Glorious Gonset	KT2B	rebuild a Gonset 972	Jan	34
The Dayton Downlink	W9JD/8	optimizing your OSCAR setup	Jul	24
There and Back Again	KC7O	band-scan for the TS-930S	Jul	44

VHF/UHF

America's Dream Array	AJ0N	National Radio Astronomy Observatory	Jul	18
Brew a Coffee Ground Plane	WA2OVG	easy 440-MHz antenna	Sep	30
Build a 1296 Stripper	WB6IGP	ATV downconverter	Oct	40
CB to Six	DA1GY	Hy-Gain CB on 50 MHz	Feb	22
Hear, Hear!	W6IOJ	OSCAR downlink preamp	Apr	20
Home-Brew the Blockbuster	WB2WIK	2-kW 6-meter linear	Jul	50
How Good Is Six?	KL7GLK	home-brew 6-meter rig	Jan	57
Hunt the Auto-Fox	WB6GTM	automatic fox identifier	Aug	48
Instant ATV!	W8CHK	plug-in fast-scan TV	Aug	36
Join the SMOT Team!	KA3B	alternate 2m activities	Dec	26
Just Leave Me Here To Die!	KT2B	UHF contesting at 4200 feet	Nov	14
Operate OSCAR on 10 Meters?	W6IOJ	145/435-MHz converter	Nov	36
Saga of the Willie Wand	W5RRH	6-element 2m beam	Dec	52
Satellite Supremacy	W2GEP	60-Watt UHF amplifier	Feb	18
Secrets of Cellular Radio	N1BLH	behind-the-scenes tour	Dec	44
Six for Two	KA8RCJ	6-element 2m delta loop	Sep	58
That Glorious Gonset	KT2B	rebuild a Gonset 972	Jan	34
The Dayton Downlink	W9JD/8	optimizing your OSCAR setup	Jul	24
The Downunda Project: Part I	Simpson	Dick Smith 2m transceiver	Aug	14
The Downunda Project: Part II	Simpson	assembly and alignment	Sep	17
The Rubber Duck Debunked	W4NVK	10 dB gain over a duck	May	42
The Santec Spectacular	W2IVS	two simple mods	Dec	50
Two for Two	WA4BLC	pair of 2m antennas	May	22
Zuper Zepp for VHF	WA4UZM	simple extended zepp	May	52

SPECIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices, 73 Magazine, Pine St., Peterborough NH 03458.

OAK PARK MI
DEC 1

The Oak Park High School Electronics Club will sponsor its 16th annual Swap 'N' Shop on Thanksgiving Sunday, December 1, 1985, from 8:00 am to 4:00 pm, at Oak Park High School, 13701 Oak Park Boulevard, Oak Park MI. Donation is $2.50 per person; after 12:00 noon, $1.50. 8-foot tables will cost $8.00. Refreshments will be available. For further information, send an SASE to Herman Gardner, Oak Park High School, 13701 Oak Park Boulevard, Oak Park MI 48237; (313)-968-2675.

FARIBAULT MN
DEC 7

The Handi-Ham Winter Hamfest will be held on Saturday, December 7, 1985, beginning at 9:00 am, at the Eagles Club in Faribault MN. Talk-in on .19/.79. For more information, contact Don Franz WØFIT, 1114 Frank Avenue, Albert Lea MN 56007.

SOUTH BEND IN
JAN 5

A hamfest will be held on January 5, 1986, at Century Center, on US 33 North between the St. Joseph Bank Building and the river, downtown South Bend IN. Table space is $1.00 per foot. Talk-in on .52/.52, .99/.39, .93/.33, .69/.09, and 145.29. For more information, contact Wayne Werts K9IXU, 1889 Riverside Drive, South Bend IN 46616; (219)-233-5307.

WAUKESHA COUNTY WI
JAN 11

The West Allis Radio Amateur Club will sponsor the Midwinter Swapfest on Saturday, January 11, 1986, beginning at 8:00 am, at the Waukesha County Expo Center Forum. Take I-94 to Co. F, south to FT, and west to Expo. Admission is $2.00 in advance and $3.00 at the door. Four-foot tables are $3.00 in advance, $4.00 at the door. For tickets or more information, send an SASE to WARAC Swapfest, PO Box 1072, Milwaukee, WI 53201.

VA STATE FAIRGROUNDS
JAN 12

The Richmond Amateur Telecommunications Society will sponsor the ninth annual Richmond Frostfest on Sunday, January 12, 1986, from 8:30 am to 3:30 pm, at the Virginia State Fairgrounds. Admission is $4.00. Flea-market spaces are $4.00; $8.00 with an 8-foot table. VEC exams will be held on Saturday. For more information, write the Richmond Frostfest, PO Box 1070, Richmond VA 23208, or call Bill Scruggs N4DDM at (804)-272-8206.

YONKERS NY
JAN 26

The Yonkers Amateur Radio Club will hold an electronics auction on Sunday, January 26, 1986, from 9:00 am to 3:00 pm, at Lemko Hall, 556 Yonkers Avenue, Yonkers NY. Admission is $3.00; children under 8 are free. Inspection is from 9:00 am to 10:00 am and the auction will begin at 10:00 am. Talk-in on 146.865/R, 440.150/R, and 146.52. For more information, contact the YARC, 53 Hayward Avenue, Yonkers NY 10704; (914)-969-1053.

SOUTHFIELD MI
JAN 26

The Southfield High School ARC will hold its 20th annual Swap and Shop on January 26, 1986, from 8:00 am to 3:00 pm, at Southfield High School, 24675 Lahser, Southfield MI. Admission is $2.50. Two 8-foot reserved tables are $20.00. Each additional table is $10.00. For more information, write Robert Younker, Southfield High School, 24675 Lahser, Southfield MI 48034.

TEACHER IN SPACE
JANUARY

The Concord Brasspounders ARC will operate W1OC to commemorate Christa McAuliffe's teacher-in-space flight of the space shuttle. Operation will be from 1300 UTC on Saturday to 1259 UTC Sunday during the first weekend following the launch of the shuttle with Christa aboard. Anticipated launch date is January 22, 1986. Suggested frequencies are: phone—7.285, 14.285, 21.385; CW—7.050, 14.050, 21.050; Novice—7.105. For a certificate, send an SASE to W1OC, PO Box 2214, Concord NH 03301.

BATTLE OF KWAJALEIN AND ROI-NAMUR
FEB 1-10

The Kwajalein Amateur Radio Club will operate special-event station KX6BU from 0600 UTC on February 1, 1986, until 0600 UTC on February 10, 1986, to commemorate the 42nd anniversary of the Battle of Kwajalein and Roi-Namur. Frequencies will be: SSB—28.550, 21.350, and 14.250; CW—28.050, 21.050, 14.050, and 7.025. For $6.00, stations working KX6BU will be issued a certificate, a QSL, and a 64-page book describing the Battle of Kwajalein and Roi-Namur. $3.00 will bring a QSL and a certificate. All requests should be sent to: KX6BU, Box 444, APO San Francisco 96555-008.

DAVENPORT IA
FEB 23

The Davenport Radio Amateur Club will hold its 15th annual hamfest at the Davenport Masonic Temple, Brady Street (Highway 61) and 7th Street, Davenport IA, on Sunday, February 23, 1986, from 8:00 am to 4:00 pm. Admission is $2.00 in advance; $3.00 at the door. Tables are available by reservation for $7.00, with $2.00 extra for ac hookup. Table setup begins at 7:00 am. Talk-in on 146.28/.88 (WØBXR). For reservations, advance tickets, or more information, contact Dave Johannsen, 2131 Myrtle Street, Davenport IA 52804.

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

COMMENTS

This month's contest information is a little spare as everyone is deciding on what dates to use for the 1986 season. Shown in the calendar are the tentative ARRL contest dates for the first six months of 1986, following the usual December and January contests that have been confirmed so far. Note the addition of five new "sprints" for 50 MHz and above, by the ARRL.

One final reminder to contest sponsors, since everyone seems to be forgetting. *Please send your contest announcements, plus appropriate rules, directly to my home address, shown here.* Material addressed to the magazine is only delayed and may not make the appropriate issue. This is especially important for overseas mail, which usually arrives at the last minute.

While on the subject, all material should be mailed *as far in advance as possible.* Believe it or not, my deadline for submission of material to the magazine is the 20th of the month, three months prior to the issue date. For example, this material for the December, 1985, issue was due at the magazine on September 20th. So please mail early; don't forget that I need a few extra days to type everything, too.

If you pick a contest date early in the year (even if you're still deciding on rules), at least let me know the date once it's firm. That way it can be listed in the calendar as early as possible and we can help avoid overlapping and duplications with other contests. I'll also know whether or not you're sending more materials and can try to track it down if it doesn't arrive on time.

That's it for now. Good luck in the coming year!

ARRL 160-METER CONTEST
Starts: 2200 UTC December 7
Ends: 1600 UTC December 6

The object is for amateurs worldwide to exchange QSO information with W/VE amateurs on 1.8 MHz, CW only. DX-to-DX QSOs are not permitted for contest credit. Operating categories include single operator and multi-operator (single transmitter only). Remember that W/VE stations may transmit only in the 1.800–1.825- and 1.830–1.850-MHz segments in conformance to the ARRL band plan. Please refrain from using the 1.825–1.830-MHz DX window.

EXCHANGE:

RST and ARRL section, DXCC country name, or ITU region if maritime or aeronautical mobile.

SCORING:

Count 2 points per QSO with amateurs in an ARRL section. W/VE stations count 5 points for DX QSOs. Multiply QSO points by total number of ARRL sections (74 maximum) and DXCC countries (W/VE stations only).

ENTRIES:

Official forms and logs are recommended and are available from ARRL headquarters for an SASE or 2 IRCs. Logs must indicate time in UTC, call, and exchange. Multipliers should be clearly marked in the log the first time worked. Entries with more than 200 QSOs must include cross-check sheets. Entries must be postmarked by January 4th and addressed to ARRL, 225 Main St., Newington CT 06111.

Certificates will be awarded the top-scoring single operator in each ARRL section and DXCC country and to the top-scoring multi-operator stations in each ARRL division and continent. Usual ARRL conditions of entry and disqualification apply.

ARRL 10-METER CONTEST
Starts: 0000 UTC December 14
Ends: 2400 UTC December 15

Contact as many stations as possible on the 28-MHz band using no more than 36 hours of the 48-hour contest period. Listening time counts as operating time! Entry categories include: single operator mixed mode (phone and CW), phone only, or CW only. Multi-operator class is for single transmitter, mixed mode only.

No crossmode contacts are allowed. Mixed-mode, single-operator, and all multi-operator stations may work stations once on CW and once on SSB. One operator may not use more than one callsign from any given location during the contest period. All entrants may transmit only one signal on the air at any given time.

EXCHANGE:

W/VE stations (including KH6/KL7) send RS(T) and state or province. DX stations send RS(T) and serial number starting with

1985 RESULTS
75-METER WORLD SSB CHAMPIONSHIP CONTEST
Callsign, QTH, QSOs, multipliers, total score
**World Champion *State, Provincial, or Country Champion

W/VE Single Operator

**K4JPD	GA	1,153	117	754,650
* N7DF/Ø	KS	1,265	91	596,505
NØXA	KS	888	84	396,060
* VE3CYX	ONT	681	86	317,770
* N4KMY	NC	747	75	291,000
* KC8P	MI	627	76	248,140
* AK1A	NH	709	66	239,910
* KVØI	NE	720	56	202,720
KB8LM	MI	553	63	177,345
* K9JF/7	WA	476	64	168,960
* KQ3V	PA	422	74	167,980
* N4TG	TN	563	58	164,430
* KB9S	WI	453	64	149,120
* KA2AEV	NY	462	60	143,100
* W1BR	MA	421	61	133,895
KB8PK	MI	471	55	129,525
* KA1SR	RI	401	62	129,270
* AA4UE	VA	454	55	127,875
* KKØL	CO	458	55	125,950
N2BJX	NY	456	54	124,740
* KD7SP	NV	404	56	115,640
WA1UJU	WI	463	49	113,925
W4TMR	NC	366	60	113,400
* KS7T	MT	361	55	104,225
* KBØC/9	IN	386	49	96,050
WA1BBB	NY	349	51	88,995
N4KWX	VA	354	42	75,180
* W9UCW WB9NUL op.	IL	266	53	70,755
* WR4F	KY	238	56	69,440
* AE5H	MS	270	48	65,280
AF1T	MA	242	51	64,515
* KI4RE	GA	234	49	58,555
* N3AHA	DE	231	45	52,650
* KD8PT	WV	216	44	51,480
* VE2YU	QUE	196	47	47,940
* K5GOE	AR	175	50	44,000
* VE1BDT	NS	191	44	43,780
KW2J	NY	190	45	43,200
* WA6FGV	CA	209	39	41,340
W9LYN	IL	158	50	41,000
* KQ7Y	AZ	175	46	40,940
* KB8KW/7	WY	162	47	39,010
W8VEN	WV	155	48	38,400
W3ARK	PA	208	35	36,400
KA2CDJ/4	NC	127	48	31,920
W3KHQ	PA	108	49	28,420
KQ1F	MA	115	46	27,600
NØCLV	KS	133	40	26,600
* W4WIJ	FL	113	44	25,520
KG6MO	CA	103	45	24,525
N7RO	WA	122	39	23,790
WA4BSN	GA	180	42	23,140
* KT1J	VT	116	38	22,420
WK4F	FL	95	42	21,630
* VE7AO	BC	102	39	21,450
KB7M	WY	115	34	19,550
VE2DTI	QUE	103	37	19,240
N4UH	NC	83	43	19,135
WB2TKD	NY	95	36	17,820
* WBØBHF	IA	102	33	16,500
K5GN	TX	84	36	15,660
K8CV	MI	74	40	14,800
WD9IFS	IL	69	37	12,765
NA8W	OH	70	35	12,600
NE6I	CA	73	33	12,210
K8KUH	MI	89	27	12,015
WB8YEW	OH	68	33	11,385
W8SWN	MI	74	30	11,100
W4TWW	SC	49	38	10,070
KB7WN	WY	57	32	9,120
KC3LV	PA	60	27	8,100
N5AFV	OK	48	31	7,440
K2SCU/5	TX	44	31	6,975
NJ8L	OH	49	27	6,750
WA8GLF	OH	54	23	6,440
WØNGB	MN	43	22	4,730
KØUK	CO	35	25	4,500
WA1NCN	CT	46	18	4,050
N8CEO	MI	28	18	2,610
AFØS	CO	17	15	1,425
W1LUG/4	VA	8	7	240

DX Single Operator

**NP4CC	Puerto Rico	512	97	288,090
* OH1RY	Finland	296	65	189,150
* DF9ZP	West Germany	246	79	123,240
* VK6DU	Australia	199	50	99,550
* K3WGR/ VP2M	Montserrat	282	61	94,855
* AH2U	Guam	179	27	46,575
* HC1OT	Equador	126	50	34,500
* HR1FC	Honduras	105	48	31,200
* KF7S/ KL7	Alaska	231	26	30,030
JF2DQJ	Japan	61	24	12,960
JA2YKA	Japan	61	24	12,960
EA3CCN	Spain	28	12	3,360
YU3PG	Yugoslavia	25	14	1,850
LZ1KOZ	Bulgaria	22	11	1,210
YU4EZC	Yugoslavia	14	11	770
OZ3ZK	Denmark	7	4	280

W/VE Multi-Operator

**K3TUP	PA	1,180	97	614,495
* W8LT	OH	1,120	92	530,380
* W9WI	WI	1,025	76	400,520
* NO4R	KY	964	75	369,375
* KYØS	CO	892	76	364,420
* KS9O	IL	757	77	303,380
* WA6PVA/7	OR	737	67	278,385
* WA5VVT	AR	558	64	181,760
* W9QVE	IL	197	50	49,250

DX Multi-Operator

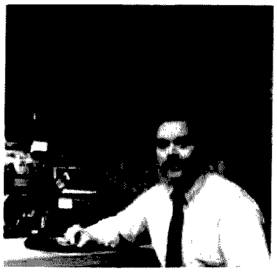
**OK3KFF	Czechoslovakia	138	27	18,900
JA9YBA	Japan	3	3	90

Check Logs: ZF2GO, K3OX, NØBQW, LZ1L73

Multi-Op Participants

K3TUP	K3TUP, KJ3L, N3BJ, AI8S
OK3KFF	OK3KFF, OK3CQA, OK3-27147
NO4R	NO4R, NC9C, KI4DC
WA5VVT	WA5VVT, WB5LRP, KA5NLY, WB5GFA
WA6PVA	WA6PVA, NI7I, N7GPO
W8LT	W8LT, K3JT, WD8LXX, WD8IXE, NZ4K, KD8NS
JA9YBA	JA9YBA, JA9LNJ, JA9VDA
KS9O	KS9O, NB9T, KA9DVY
W9WI	W9WI, K9BC, AC9C, NA9D
KYØS	KYØS, ADØO, NØEBM

RESULTS



75-meter single-op World Champion K4JPD.

DF9ZP recovers from the 1985 75-meter test.

The ops at 75-meter multi-op runner-up W8LT. (Left to right: WD8IXE, NZ4K, WD8LXX, KD8NS, and K3JT.)

K4JPD, K3TUP, NP4CC, AND OK3KFF WORLD 75-METER SSB CHAMPIONS

With a smashing total of 117 multipliers and 1153 QSOs, K4JPD is the 1985 World 75-Meter Champion in the W/VE single-operator class. K3TUP (three-time 40-Meter Champion) has become the World Champion in the 75-Meter W/VE multi-operator class with 1180 QSOs and 97 multipliers.

NP4CC earned World Championship honors by capturing the top slot for DX single-operator stations. With 512 Qs and 97 multipliers, NP4CC's score totaled 288,090 contest points.

In the DX multi-operator class, OK3KFF has the distinction of becoming the 1985 World Champion in that category.

New champions sometimes breed new world records. This year's 75-meter event is no exception. N7DF and three fellow competitors broke the standing World QSO Record established in 1984. Including this year's accomplishments, the following are the top ten QSO totals:

75-Meter QSO Records

N7DF	1985	1,265	W9WI	1985	1,025
K3TUP	1985	1,180	NO4R	1985	964
K4JPD	1985	1,153	N4BAA	1984	894
W8LT	1985	1,120	KYØS	1985	892
N7DF	1984	1,076	NØXA	1985	888

Can you imagine over 1000 Qs on 75 meters in 24 hours or less? Unbelievable, huh? In the 1985 contest, stations making 500 or more contacts included: N7DF (1265), K3TUP (1180), K4JPD (1153), W8LT (1120), W9WI (1025), NO4R (964), KYØS (892), NØXA (888), KS9O (757), N4KMY (747), WA6PVA (737), KVØI (720), AK1A (709), VE3CYX (681), KC8P (627), N4TG (563), WA5VVT (558), KB8LM (553), and NP4CC (512).

Stations compiling 70 or more multipliers included: K4JPD (117), K3TUP (97), NP4CC (97), W8LT (92), N7DF (91), VE3CYX (86), NØXA (84), DF9ZP (79), KS9O (77), KC8P (76), W9WI (76), KYØS (76), NO4R (75), N4KMY (75), and KQ3V (74).

One of the advantages of grading contest entries is the opportunity to learn what fellow competitors are using to radiate their signals. From this year's logs, here is an extract of what we learned:

Antennas Used (%) in the 75-Meter Contest

Inverted vee/dipole	57.5
Slopers	19.8
Trapped vertical	8.5
Delta loop	8.5
Wire beam	3.8
2-element yagi	0.9
Collins cage	0.9

Looking to the top stations in each operator class, here are half the ingredients to this year's championship stations:

Single Op:

K4JPD	GA	FT-102	2-el yagi
N7DF	KS	FT-901/FT-902	Collins discage
K9JF	WA	TS-830S	Vertical
N4TG	TN	IC-720	Tilted delta loop
KB8PK	MI	TS-430S	Inverted vee

Multi-Op:

K3TUP	PA	TS-930	???? (a secret?)
W8LT	OH	TS-830S/TS-930S	Dipole and longwire
W9WI	WI	TS-830S	Zepp, inv. vee, verticals
NO4R	KY	Drake C-line	Dipole
WA4JXI	FL	TS-830	Phased ¼-wave slopers

If only a new, compact, 80-meter 2-element beam design would hit the market. Then next year we could all share the success enjoyed by K4JPD. Hey, Steve, how about sending me (KE7C) the plans for your new array? Seriously, Buck (WB7OJV) and I would like to put one up!

As the many cards and letters state, everyone is looking forward to the 1986 event. The summer of 85 was busy here at the QTH, getting an array set up for 75. How about your QTH? Are you ready for January?

Mark it down on your calendar. The 5th annual 75-Meter World SSB Championship will be held from 0000-2400 UTC on January 12, 1986. Send for your paperwork right now. It's printed and ready for mailing to you!

Forward an SASE to our new rules and forms address. We'll send you not only the information for the 75-Meter contest, but also the rules and forms for our other contests as well. Address your SASE to: *1986 Contest Rules and Forms, Billy Maddox KA6JJK/3, 1162 Bayview Vista Drive, Annapolis MD 21401.* See you in January!—*Bill Gosney KE7C.*

75-Meter Soapbox

N4BAA	Sorry I didn't get to operate! Really missed hearing K4JPD's new KLM beam. Everyone has been talking about it. Good job, Steve.
W4TWW	Very nice contest.
KE7C	Couldn't operate but sure look forward to next season. Lots of 75m antenna work this summer. Maybe KLM will ship a 2-element yagi my way just for me to test out. . .pssst, hint, hint.
N7DF	Got to get a computer! Duping by hand is for the birds! Great contest, fellas. Lots of fun.
DF9ZP	Jose, best to you and the contest committee. Very nice contest. See you next year.
JF2DQS	Conditions were very bad. Not many East Coast stations. Of course, see you in 86.
ZF2GO	Waste of time. Nobody listened in the DX window. *(Hopefully the new DX-window rules for 86 will improve the situation. . .let's hope so—Ed.)*

001. Maritime- and aeronautical-mobile stations send RS(T) and ITU region (1, 2, 3). Novice and Technician stations sign /N or /T as appropriate.

SCORING:

Count 2 points per phone QSO, 4 points per CW QSO, and 8 points for QSOs with US Novice or Technician stations. Multiply the QSO points by the total number of US states, Canadian call areas, DXCC countries (except US and Canada), and ITU regions (maritime and aeronautical mobiles only).

ENTRIES:

Official logs and entry forms are recommended and are available from ARRL headquarters for an SASE or 2 IRCs. Logs must indicate time in UTC, mode, call, and exchange for each QSO. Multipliers should be clearly marked in the log the first time worked. Entries with more than 500 QSOs must include cross-check sheets. Entries must be postmarked by January 11th and addressed to ARRL, 225 Main St., Newington CT 06111.

Certificates will be awarded to the highest-scoring single-operator station in each category from each ARRL section and DXCC country, top multi-operator entries in each ARRL division and each continent, and additional entries as participation warrants. Usual ARRL entry conditions and disqualification rules apply.

G-QRP-CLUB WINTER SPORTS

Daily from 0900 to 2300 UTC, December 26th to January 1st. All radio amateurs interested in QRP are invited to take part in the club's activity. No special exchange information was mentioned in the information provided by the club. The operating schedule for each day is as follows:

0900–1100 = 14.060, 21.060, 28.060
1100–1300 = 3.560, 7.030
1300–1400 = 10.106
1400–1700 = 14.060, 21.060, 28.060
1700–1900 = 3.560, 7.030
1900–2100 = 14.060
2100–2300 = 3.560, 7.030

Reports on the Winter Sports Activity should be sent to Fred Garratt G4HOM, 47 Tilshead Close, Druids Heath, Birmingham B14 5LT, England.

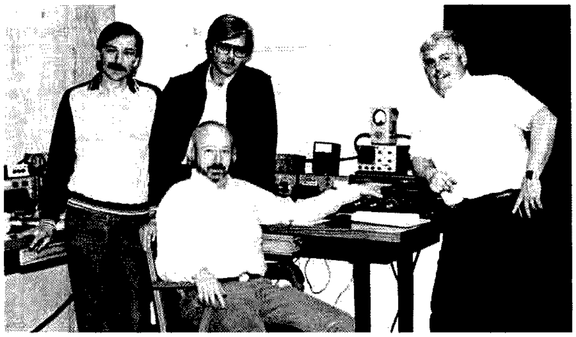
CANADA CONTEST

Starts: 0000 UTC December 29
Ends: 2400 UTC December 29

Sponsored by the Canadian Amateur Radio Federation (CARF), the contest is open to all amateurs and everybody works everybody. Entry classes include single operator allband, single operator single band, and multi-operator allband.

Use all bands from 160 to 2 meters on CW and phone combined. All contacts with amateur stations are valid. Stations may be worked twice on each band, once

RESULTS



The 160-meter multi-op World Champions at WB8IFP. (Left to right: WD8ROD, KC8CP, WB8IFP; WA8PRA sitting.)

N7DF, WB8IFP, I4OUT, AND G6HH WORLD 160-METER SSB CHAMPIONS

A difference of 24 contacts determined this year's World Champion for single-operator stations. It has to be a heartbreak for WØEJ, who placed second behind World Champ N7DF. Both stations worked 56 states/provinces and 13 DX countries. Both stations beat N7DF's 1984 World QSO Record!

The multi-operator category was just as exciting. WB8IFP became the World Champion by less than 8,000 points. Second-place station WØCEM managed 30 contacts more than the champ, however the multiplier count was 3 less. Here again, it was a fine line between the two. Scores that close must be very, very frustrating.

In DX, the competition was more relaxed. I4OUT nearly doubled the score of runner-up YV2IF. He compiled 367 Qs, 10 states/provinces, and 43 DX countries to earn the title for single-op DX stations.

In the multi-operator category for DX stations, G6HH was unchallenged with a score of 25,680 contest points.

Speaking of world champions and record-breaking scores, let's review the history of this event:

	1981	1982	1983	1984	1985
W/VE Single Op	W8LRL	W9RE	KC8JH	WA2SPL	N7DF
W/VE Multi-Op	W4CN	W8NGO	K8ND	K9ZUH	WB8IFP
DX Single Op	C6ADV	VP9BO	YV3AZC	EA3CCN	I4OUT
DX Multi-Op	ZF2DX		YU7JDE	LZ2CJ	G6HH

1985 meant new world records. With the sunspot cycle favoring 160, QSO counts have reached new horizons. Let's look at the top ten to date:

160-Meter QSO Records

N7DF	1985	1,177	WØCEM	1985	1,084
WØEJ	1985	1,152	WB8IFP	1985	1,054
N7DF	1984	1,125	KC8P	1985	1,048
W9RE	1982	1,118	VE3CDX	1984	1,003
WA2SPL	1984	1,098	KØHA	1984	991

During the 1985 contest, stations achieving 500 or more QSOs included: N7DF (1,177), WØEJ (1,152), WØCEM (1,084), WB8IFP (1,054), WB9NUL (885), NO4R (871), K1ZM (841), W8KA (754), W3TS (743), WA1UJU (737), N8ATR (721), W4TMR (720), W1ODY (690), KC8P (645), WD4KXB (639), NK7U (622), N4FNB (607), K3MO (590), WØIJR (550), and N4DDS (509).

Stations with 50 or more states/provinces included: WB8IFP (57), WØCEM (56), W8KA (56), N7DF (56), K7QQ (56), WØEJ (56), WB9NUL (55), WØIJR (54), WA4JXI (54), NK7U (54), K1ZM (54), K3MO (54), NO4R (53), K7LXC (53), WD4KXB (53), W3TS (53), WA1UJU (53), KC8P (52), W4TMR (52), WB1GQR (52), KA1SR (52), W8SVT (52), N4ICS (52), N8ATR (51), N4BNO (51), and VE5RA (50).

In Europe, DX activity was fairly good. The following stations worked 20 or more DX countries: I4OUT (43), EA3CCN (36), SP5INQ (33), OK1JDX (31), LZ1KOZ (30), C31OF (27), I4CSB (23), G6HH (22), and YV2IF (21).

On the North American continent, the following stations worked 10 or more DX countries: WA4JXI (33), K1ZM (27), W1ODY (15), W8KA (15), KA1SR (14), N7DF (13), WØEJ (13), WD4KXB (12), NK7U (11), KQ1F (11), and N8ATR (10).

For years operators have claimed they couldn't put up a 160 antenna on a city lot. Each year we analyze the 160-meter entries just to disprove this myth. Here's what contestants used in the 1985 event:

Antennas Used (%) in the 160-Meter Contest

Longwire	38.9
Slopers	33.3
Inverted vee/dipole	11.1
Other	11.1
Vertical	5.6

35.7% of the participants used a Beverage or series of Beverage antennas for receive.

As far as the top five stations are concerned, you'll find a blend of state-of-the-art equipment and a variation of antenna designs that have appeared in radio journals the past few years. A bit of effort, yes, but think of the signal:

Single Op:

N7DF	KS	FT-901/FT-902	Discage, Beverages
WØEJ	IA	KWM-380	¼-wave sloper, Beverages
K1ZM	NY	TS-830	136′ vertical
WB9NUL	IL	????	????
W1ODY	CT	????	????

Multi-Op:

WB8IFP	OH	Drake C-line	¼-wave vertical, Beverages
WØCEM	KS	TS-830S	Phased verticals, Rx loop
W8RA	MI	TS-830S	130′ folded unipole, Beverage
NO4R	KY	Drake C-line	Shunt-fed tower
WA4JXI	FL	TS-830	115′ shunt-fed tower, Beverages

160-meter contesting is at its very best. This event has become the unchallenged favorite of SSB contesters worldwide.

Plan now to reserve the 1986 contest weekend. The 7th annual 160-Meter World SSB Championship will be held from 0000 UTC January 18, to 2400 UTC January 19, 1986.

Send an SASE to the address below and obtain your own personal copy of the new and revised rules and forms. Once your SASE is received, we'll not only send you the forms and rules for the 160-meter event, but also the information for all of the SSB championship events: *1986 Contest Rules and Forms, Billy Maddox KA6JJK/3, 1162 Bayview Vista Drive, Annapolis MD 21401.*

My thanks to Harry K1PLR. Harry has been our contest chairman for the past several years. We owe our gratitude to Harry for handling all the details without a flaw. He managed the 1985 event right in the middle of moving from Pennsylvania to North Carolina. Great job, Harry, and our thanks again!

To the contestants, you're special people. On 160, we call it the gentleman's band and rightly so! *73* appreciates your dedication and looks forward to your annual support. Be sure to share your contesting excitement with your 160 friends. Fine-tune that antenna and let's do it again in 1986, okay!—*Bill Gosney KE7C.*

160-Meter Soapbox

KE7C	Only sorry I couldn't stay around longer. Was nice to contact old friends and meet many new ones! Hats off to Harry K1PLR, who chairs this event each year!
KC7PA	Noise plague again. Utah is still considered rare, however.
KS7T	Rough on this end. Ran barefoot. Need either a tape recorder or a linear.
KC8P	Snow static was S9 +40 at times. Decided to pull the plug and go to bed.
WØCEM	We all had a good time. When the temp is −20 outside, the best thing to do is to contest on 160!
KCØQO	Big effort + low score = lots of fun!

on CW and once on phone. Neither cross-mode contacts nor CW contacts in the phone bands are allowed.

EXCHANGE:

Signal report and consecutive serial number starting with 001, plus province.

SCORING:

Score 10 points for each contact with Canada, 4 points for contacts with other countries. VEØ counts as Canada and one multiplier. Score 20 points for each contact with any CARF official news station using the suffix TCA or VCA. Multipliers are the number of Canadian provinces/territories worked on each band, on each mode. Contacts with stations outside Canada count for points but not multipliers.

FREQUENCIES:

1.810/1.840, 3.525/3.775, 7.025/7.070/7.155, 14.025/14.150, 21.025/21.250, 28.025/28.500, 50.040/50.110, and 14.4090/14.6520. Suggest phone on the hour, CW on the half hour. Since this is a Canadian-sponsored contest, remember to stay within the legal frequencies for your country!

AWARDS:

Trophies will be awarded to the highest-scoring single- and multi-operator allband entries. Certificates will be awarded to the highest scorer in each category in each province/territory, US call area, and DX country.

ENTRIES:

A valid entry must contain log sheets, dupe sheets or statement, a cover sheet showing claimed QSO points, a list of multipliers, and a calculation of final claimed score. Cover sheets and multiplier check-lists are available. Entries should be mailed within one month of the contest with your comments, photos, etc., to CARF, c/o N. Waltho VE6VW, Box 1890, Morinville, AB, T0G 1P0, Canada.

Results will be published in *TCA*, the Canadian amateur magazine, prior to the next contest. Nonmembers of CARF may include an SASE for a copy of the results.

The decision of the contest committee shall be final in all cases of dispute.

WORLD SSB CHAMPIONSHIPS

Announcing the January Classics—the 1986 running of the World SSB Championships! The first and only contests of their kind, these five (5) individual single-band events are world-renowned and amongst the most challenging events on the bands today. Winners of each contest determine the World Champion for 15-, 20-, 40-, 75-, and 160-meter single sideband:

January 11, 1986
0000–2400 UTC
5th 40-Meter World SSB Championship

January 12, 1986
0000-2400 UTC
5th 75-Meter World SSB Championship

0000 UTC January 18, 1986,
through 2400 UTC January 19, 1986
7th 160-Meter World SSB Championship

January 25, 1986
0000-2400 UTC
2nd 15-Meter World SSB Championship

January 26, 1986
0000-2400 UTC
2nd 20-Meter World SSB Championship

Stations may be worked only *once per event*. All contacts must be two-way SSB. All stations, regardless of operating class, may operate the entire contest period.

OPERATOR CLASS:

(a) single operator, single transmitter, SSB only; (b) multi-operator, single transmitter, SSB only.

EXCHANGE:

Stations within the 48 continental US states and 13 Canadian provinces or territories transmit RS report and state, province, or territory. All others, including Alaska and Hawaii, transmit RS report and ARRL DXCC country.

QSO POINTS:

5 QSO points for contacts *within* your own *continent*.

10 QSO points for contacts *outside* your own *continent*.

MULTIPLIERS:

1 multiplier point is earned for each continental US state (48 max.), Canadian province or territory (13 max.), or ARRL DXCC country (excluding the United States and Canada).

SUGGESTED FREQUENCIES:

21.250-21.350; 14.175-14.250; 7.050-7.080 (DX); 7.175-7.250 (W/VE); 3.760-3.790; 3.805-3.875; 1.830-1.850; 1.855-1.900 MHz.

DX WINDOW:

For the purpose of this event, DX window frequencies are reserved for *split-band operation only*. W/VE stations are *not* to transmit in the window at all. DX stations *may* transmit but *must* receive outside the window frequencies. DX windows include 7.080-7.090, 3.790-3.805, 1.825-1.830, 1.850-1.855, and 1.907-1.913 MHz.

FINAL SCORE:

Total QSO points × multiplier points = claimed score.

ENTRIES:

Entries *must* include (1) a contest log, (2) a dupe sheet for 100 or more contacts, (3) a list of multipliers, and (4) a summary sheet as outlined below. Be sure to *include* your *soapbox comments* and a black and white *photo* for possible publication.

SUMMARY SHEET:

Summary sheets must contain (1) contest callsign, (2) your state, province, territory, or ARRL DXCC country, (3) station owner's name and mailing address, (4) a list of station equipment and antenna(s), (5) the operator class, (6) total QSOs, (7) total QSO points earned, (8) total US states worked, (9) Canadian provinces and territories worked, (10) the total of ARRL DXCC countries worked, (11) total multiplier points, and (12) your claimed contest score.

ENTRY DEADLINE:

Entries should be mailed to the appropriate contest chairman listed below. Entries must be *POSTMARKED NO LATER THAN FEBRUARY 20, 1986.* Late entries will be registered as check logs.

DISQUALIFICATION:

Contestants may be disqualified if they run illegal power, cause deliberate interference, fail to comply with the rules for the DX window, attempt to achieve a scoring advantage, or if duplicate contacts not cancelled exceed more than 3% of the total contacts made. Decisions of the contest committee are final. Disqualified stations will be barred from these events for one year thereafter.

PENALTIES:

A penalty of 100 QSO points will be as-

1985 RESULTS
160-METER WORLD SSB CHAMPIONSHIP CONTEST
Callsign, QTH, QSOs, State/Provinces, DX, total score
** World Champion *State, Provincial, or Country Champion

W/VE Single Operator

**N7DF	KS	1,177	56	13	411,240
*W0EJ	IA	1,152	56	13	401,580
*K1ZM	NY	841	54	27	363,690
*WB9NUL	IL	885	55	9	282,880
*W1ODY	CT	690	47	15	228,690
*N8ATR	OH	721	51	10	223,260
*WD4KXB	VA	639	53	12	211,575
*W3TS	PA	743	53	3	208,880
*KC8P	MI	645	52	7	195,900
*WA1UJU	WI	737	53	0	195,305
*W4TMR	NC	720	52	5	193,230
K3MO	PA	590	54	5	176,705
N4BNO	NC	466	51	9	142,800
*WB1GQR	VT	436	52	9	139,690
*KA1SR	RI	385	52	14	133,650
W8SVT	OH	400	52	7	120,075
*K6HNZ	CA	440	46	5	115,515
*W7AWA	WA	403	44	7	104,550
K7QQ	WA	345	56	0	98,560
*KQ1F	MA	359	41	11	93,600
*K4JPD	GA	318	45	6	84,960
AF1T	NH	337	46	0	77,510
*N4ICS	KY	288	52	1	76,055
W8ILC	OH	287	48	3	73,950
KB3MI	PA	271	47	5	71,760
WA1BBB	NY	317	42	1	69,015
*N5GDO	MS	282	47	1	68,160
KA8T	MI	291	41	0	59,655
K8WW	OH	282	41	0	57,810
*VE5RA	SASK	209	50	4	57,510
KR9G	IL	165	48	2	41,750
N4NX	GA	170	40	7	41,595
*KV0I	NE	191	36	0	34,390
*W2CVW	NJ	152	37	4	31,980
N4UH	NC	166	37	1	31,730
*W4TWW	SC	132	39	4	31,020
*KS7T	MT	139	42	0	29,610
WI4R	GA	159	36	0	28,980
*W8VEN	WV	143	37	2	28,275
KG9D	IL	139	40	0	27,800
*VE7ERY	BC	141	38	1	27,690
N5DSK	MS	129	38	4	26,250
N3ADQ	MA	184	28	0	25,760
*KC7PA	UT	133	32	1	22,110
*VE4WR	MAN	107	41	0	21,935
*KA7T	ID	123	33	1	21,250
N8AXA/ORP	OH	126	33	0	20,795
*VE3IHB	ONT	122	33	0	20,135
WB6JMS	CA	113	34	1	20,125
*N4BSN	TN	108	35	1	19,650
KC3LV	PA	109	35	0	19,075
KI4UJ	KY	121	31	0	18,755
*WB5WAK	LA	107	35	0	18,725
WA8MJY	MI	100	36	0	18,000
VE2DTI	QUE	102	34	0	17,340
NA2Q	NY	105	33	3	16,920
AA4NA	FL	92	32	1	15,345
K9ZMI	IL	88	33	0	14,520
VE5AFY	SASK	116	27	0	14,500
K4JLD	PA	105	26	1	14,310
W0RSG	CO	83	34	0	14,110
K8CV	MI	88	25	0	12,760
N9KS	WI	73	29	0	10,585
WB2TKD	NY	65	29	2	10,385
KB7M	WY	74	28	0	10,360
K1KI	CT	62	28	0	8,680
N3AOE	MD	70	24	0	7,680
WA6FGV	CA	102	13	1	7,210
N6JM	CA	65	20	1	7,035
KC0QO	MO	54	22	0	5,940
W1LUG/4	VA	41	23	0	4,715
K5GN	TX	42	22	0	4,620
N3RC	VA	33	17	0	2,805
AA6EE	CA	21	13	0	1,365
W0IZV	CO	18	12	0	1,080

DX Single Operator

**I4OUT	Italy	367	10	43	188,415
*YV2IF	Venezuela	180	40	21	109,800
*EA3CCN	Spain	193	2	36	72,580
*OK1JDX	Czechoslovakia	178	5	31	31,320
*C31OF	Andorra	106	1	27	30,100
*SP5INQ	Poland	151	2	33	28,525
*4U1UN	UN HQ	205	25	0	25,625
*LZ1KOZ	Bulgaria	115	1	30	20,150
I4CSB	Italy	53	0	23	6,440
G3SJX	England	24	0	16	3,840
OK1DVK	Czechoslovakia	31	0	15	2,400
LZ1KKZ	Bulgaria	25	0	14	2,030
DL7MAE	West Germany	23	0	10	1,150
SP6DVR	Poland	23	0	9	1,035
KL7XO	Alaska	14	6	2	840

W/VE Multi-Operator

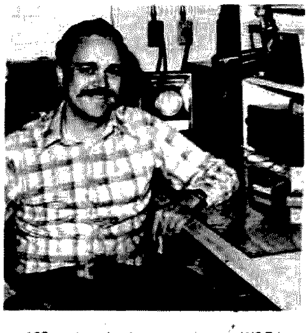
**WB8IFP	OH	1,054	57	7	340,160
*W0CEM	KS	1,084	56	5	332,450
*W8KA	MI	754	56	15	272,995
*NO4R	KY	871	53	8	268,095
*WA4JXI	FL	536	54	33	250,995
*NK7U	OR	622	54	11	207,675
*N4FNB	TN	607	48	4	158,860
*W0IJR	CO	550	54	3	157,605
N4DDS	TN	509	47	1	122,400
*K7LXC	WA	303	53	1	82,080
*WA2ZXS	NY	317	47	4	81,855
*WB4UUE	VA	264	42	5	63,215
KA7IXH	OR	154	27	1	21,840

DX Multi-Operator

**G6HH	England	109	2	22	25,680

Multi-Op Participants

WA2ZXS	KB3RG, N2FEC, N3DLL, KO2H, KA2NIL, KA2TYR
N4DDS	N4DDS, N4DRL
N4FNB	N4FNB, KA4UEU, WD4PRQ, WD4EOX
WA4JXI	WA4JXI, WA4SVO
NO4R	NO4R, NC9L, N4JXI, KI4DC
WB4UUE	WB4UUE, W4JVN
KA7IXH	KA7IXH, KA7TXF, KD7UX
K7LXC	K7LXC, ?????
NK7U	NK7U, NI7T
WB8IFP	WB8IFP, N8EZM, KC8CP, WB8KXV, WD8ROD
W8KA	W8KA, NF8C
W0CEM	W0CEM, WA0TKJ, AB0S, K0WA, WB0JHD
G6HH	G3SVL, G6HVY, G6WKL, G1ICB, G0ARY, G6ZRL, G4KMJ, G4NVQ, G4WCP
W0IJR	W0IJR, KD0OZ, KA0CDN



160-meter single-op runner-up W0EJ.

160-meter multi-op runner-up W0CEM.

CALENDAR

Dec 7-8	ARRL 160-Meter Contest
Dec 14-15	ARRL 10-Meter Contest
Dec 26-Jan 1	QRP Winter Sports—CW
Dec 29	CARF Canada Contest
Jan 1	ARRL Straight Key Night
Jan 11	73 40-Meter World SSB Championship
Jan 11-12	Hunting Lions In The Air Contest
Jan 11-12	QRP CW Contest
Jan 11-12	ARRL VHF Sweepstakes
Jan 12	73 75-Meter World SSB Championship
Jan 18	73 160-Meter World SSB Championship
Jan 24-Feb 2	ARRL Novice Roundup
Jan 25	73 15-Meter World SSB Championship
Jan 26	73 20-Meter World SSB Championship
Feb 8-9	Dutch PACC Contest
Feb 15-16	ARRL International DX Contest—CW
Mar 1-2	ARRL International DX Contest—Phone
Apr 12-13	CARF Commonwealth Phone Contest
Apr 14	ARRL 144-MHz Sprint
Apr 22	ARRL 220-MHz Sprint
Apr 30	ARRL 432-MHz Sprint
May 8	ARRL 1296-MHz Sprint
May 17	ARRL 50-MHz Sprint
Jun 7-8	ARRL VHF QSO Party
Jun 28-29	ARRL Field Day

THE AM PRESS/EXCHANGE

NEWSLETTER OF THE MONTH

This month's winner, *The AM Press/Exchange*, isn't the publication of a single club. Rather, it's a newsletter that ties together hams who love the fun and fidelity of AM communication.

Edited and published by Don Chester K4KYV, Roger Frith N4IBF, and Pete Curry KA2TTU, the *AM P/X* covers the entire spectrum of AM radio, from the restoration of antique gear to current legislation affecting AMers. The *Exchange* part of the title comes from the free classified ads available to hams wanting to buy and sell AM equipment.

To enter your club's newsletter in *73*'s Newsletter of the Month Contest, send it to *73*, 80 Pine Street, Peterborough NH 03458, Attn: Newsletter of the Month.

sessed for each duplicate contact counted in a contestant's claimed score.

AWARDS:

A minimum of 100 QSOs must be worked in an event to be eligible for a contest award. Plaques will be issued to the World Championship Stations. Awards will be issued in each operator class, in each continental US state, Canadian province and territory, and ARRL DXCC country represented.

RULES AND FORMS:

Contestants are encouraged to use official contest forms. To obtain your own copy of the rules and each contest form, send an *SASE* to: *Contest Rules and Forms, Billy Maddox KA6JJK/3, 1162 Bayview Vista Drive, Annapolis MD 21401.*

Mail Your Entry To:
15-Meter Contest Chairman
Gary Vest WA3KCY
Star Route, Box 34
Holliday TX 76366

40-Meter Contest Chairman
Dennis Younker NE6I
43261 6th Street East
Lancaster CA 93535

160-Meter Contest Chairman
Harry Arsenault K1PLR/4
704 Curtiss Drive
Garner NC 27529

20-Meter Contest Chairman
Chuck Ingram WA6R
44720 N. 11th Street East
Lancaster CA 93535

75-Meter Contest Chairman
Ron Johnson KC7PA
68 South 300 West
Brigham City UT 84302

ABOVE AND BEYOND

Peter H. Putman KT2B
84 Burnham Road
Morris Plains NJ 07950

As I mentioned last month, one of the primary obstacles to operation on 220 MHz—especially SSB and CW weak-signal modes—is the lack of equipment. As of this date, there is only one manufacturer of 220 linear transverters, with another manufacturer about to introduce a model in the next month. (No, it's *not* ICOM!) As far as the selection of preamplifiers goes, there's no problem there. I know of at least 4 sources for preamplifiers, and there are several sources for amplifiers, most of which are commercially made.

The catch, as usual, is initial cost vs. return on investment. How likely is the 220-MHz gear to be used frequently? The costs of outfitting a modest station aren't excessive, but more operating enjoyment might be had on 432 for the given cost. The problem appears to be that everybody (well, most of the licensed hams in the US and Canada) is playing this waiting game: If there's enough activity, then I'll buy some equipment and get on the band. A sort of Catch 22.

One of the ways I hope to be of use to readers is to suggest options that will yield more use and enjoyment from your equipment, or any equipment you are now contemplating buying. If you're an avid VHF/UHF nut, then you may already have dabbled on 220, and you can skip this column. But if you have a transverter, or some homemade gear, or are about to lay out the cash for a piece of 220-MHz equipment, then the rest of this column might just interest you.

One of the given factors regarding successful VHF and UHF operation is that it can never hurt to run more power. A typical 220 station might use a transverter to drive a 60- or 120-Watt solid-state amplifier, feeding a single yagi. Not a bad setup, but there are times when it would be nice to have about 3 dB more power going up the feedline to snag that rare grid or make a scatter contact. Are you in luck!

Fair Radio Sales, in Lima, Ohio, has long offered the answer to the VHF operator who is long on enthusiasm but short on cash. A glance in their 1985 catalog will reveal a strange-looking box called an "AM-6155/GRT-22" UHF power amplifier. And for $159.50, you get about 80 pounds of gear in two boxes, with a self-contained ac power supply. What is this monstrosity? Well, it's a surplus FAA-type amplifier for who knows what communications in the 225-400-MHz band, and Fair Radio has come up with quite a full warehouse. Best of all, with little modification it becomes a 400-500-Watt power amplifier for 144 and 220 MHz. The mods are simple and the parts are easy to come by. Interested? Read on.

The AM-6155 uses an Eimac-type 8930 tetrode in a grounded-cathode grid-driven configuration. Such a tube in this mode ought to have about 20 dB of gain or so, but these amplifiers are only rated at 50 Watts output. The reason is simple: Since the units were intended for continuous duty in FAA service, the input to the 8930 grid is undercoupled. Hence, 10 Watts provides about 50-60 Watts output in the unmodified mode. But there's no reason at all why, in the intermittent duty operation that hams require, the tube couldn't make more power. The only limiting factor is the power supply, which is stiff enough to provide the extra Watts.

If you have one of these beasties or have rushed to the phone and whipped out your charge card to order one, follow the instructions carefully. First, make sure the internal plunger for the input cavity is set to UHF and not VHF. Refer to Fig. 1. The input connector, J1, feeds a 1.8-pF variable at the input of the shunt cavity. Obtain a 2-pF, 250-volt or better silver-mica capacitor and shunt it across this tuning capacitor. (It's labeled "input coupling.") Then locate the input-tuning capacitor, and again, shunt it with an 18-pF, 250-volt or better silver-mica capacitor. When these modifications are complete, replace the covers and turn the power supply on. Connect your driving source (no more than 5 Watts), wattmeter, dummy load/antenna, and set the plate idling current at 50 mA. (This is accessible through the top cover.)

After you've set the idling current, key your driving source. Adjust the input-coupling and input-tuning capacitors for maximum output. You should see about 400-500 Watts with 4-5 Watts of drive. Not bad, eh? One additional thought: The connection from the amplifier output to the rear antenna jack goes through a Bird-type directional coupler, which will self-destruct at this power level. Remove it and replace it with a double-female N adapter. Use a good wattmeter and slug to make these measurements. Incidentally, this is about all the power this amplifier can make, and driving it harder will just suck the plate voltage down as the tube tries to draw more current. Set your driving source for the *minimum* amount of power needed to obtain full output, and the tube won't go into saturation.

Next, you may wish to add some means of keying the tube. One very effective way is to tie a 56-volt, 5-Watt zener from the bias line to ground through a 100-Ohm, 5-Watt resistor. By grounding the resistor/zener junction, the operating bias can be obtained. When the resistor is in the circuit, set the bias control for full cutoff, or so that no idling plate current is measured. Typically, this voltage will be around 130-140 volts negative. See Fig. 2 for this modification. Fig. 3 shows yet another way to key the amplifier, using a voltage doubler and relay to break the screen-voltage line. All you'll need is a small 12-volt relay, a pair of 1N4002/3/4 diodes, and two 200-uF, 25-V-dc electrolytics. The RCA jack is useful for keying. Merely locate and break the

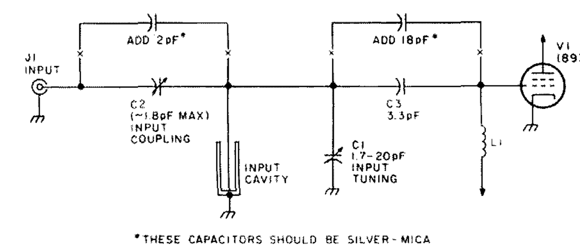


Fig. 1. The AM-6155 input circuit.

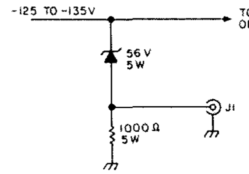


Fig. 2. Use this to set the operating bias on the 8930 by grounding J1.

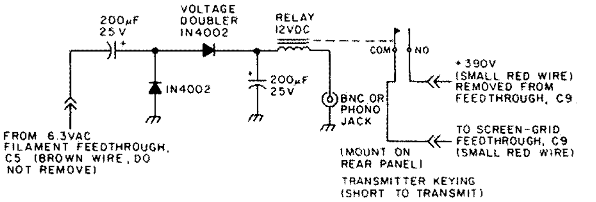


Fig. 3. One method of keying the amp. The voltage doubler will not be needed if a 6.3-V-ac relay can be located.

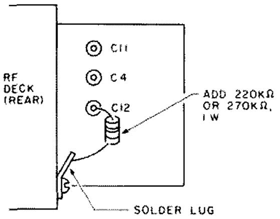


Fig. 4. Don't forget to add this resistor.

screen lead from feedthrough C9 on the tube enclosure, and install this circuit in series. Finally, add a 270k-Ohm, 1-Watt resistor from feedthrough C12 to ground on the tube enclosure. This will ensure that the screen does not take on the potential of the 2000-volt power supply when not connected. (See Fig. 4.)

There you have it! It couldn't be much easier. The unit measures 7 inches by 19 inches by 18.5 inches and will fit on a good sturdy operating table. The blower might be a bit noisy, but it's a small price to pay. From all reports, these units are fast disappearing from the Fair Radio warehouse in Ohio, and although I'm sure they have a large stock, it can't last forever. Note that a similar amplifier, designated type AM-6154, is also offered, but for more money. This unit, while offering similar performance at 144 MHz, will not cover 220 MHz. The AM-6155, while intended to operate on 220 MHz, will actually cover 144 MHz, provided that the internal cavity plunger is set to VHF. You'll need to experiment with the values of the shunt capacitors on the input, but a finished unit will behave as well as the 220 amplifier. Now there's no excuse for not working the 220-MHz tropo openings!

It would appear that grid-square mania has caught up with us all. The past ARRL September VHF QSO Party featured more stations operating portable than I can recall in a long time. Some went out of their way to put such rare grids as FN 51 in Cape Cod on the air on 144, 220, 432, and 1296 MHz. Other operations surfaced from EM 85, (Tennessee/North Carolina border), FM 08 (West Virginia), and FN 25 (Quebec). Conditions were generally mediocre, except for some sporadic openings on tropo on 432 and 1296 MHz, and a fairly good tropo opening on 144 MHz Sunday night towards the end of the contest. What a far cry from last September, when the storm lashing South and North Carolina created such intense tropo conditions that stations in Massachusetts worked Georgia on 1296 MHz! Such conditions are not likely to be seen again for a while.

As I write this, Hurricane Gloria is churning up the Atlantic Coast; she will be a memory (unpleasant for some readers, no doubt) by the time you read this. It will be interesting to see if a storm of this magnitude—Level 4, approaching 5—will create major disturbances in propagation on the higher UHF bands. Perhaps the Massachusetts-Georgia path will open again. There is certainly going to be unusual propagation observed on 144 MHz as a result of the storm, no matter where it comes ashore.

Incidentally, one easy way to set up a "beacon" monitor is to get ahold of a rudimentary secondhand television with UHF coverage and pick a station about 50-100 air miles from your QTH. Fasten a UHF high-gain antenna to your tower or mast in a fixed position towards that station. During periods of possible enhanced propagation, leave the set on while operating other bands or working around the house. You can be tipped off by increasing signal strength from the distant station. For indications of openings on lower bands, select a station in the range of channels 11, 12, or 13 about the same distance away. Use the same method of fixing a beam to your mast. Try to use a narrowband beam, and if necessary, make one. A 220 beam will do the trick if needed. You don't need to see the picture, just hear the audio. For that matter, a radio receiver with TV sound would be adequate.

Let's wrap up this column and our discussion of 220 by publishing a circuit for a dual-gate GaAsFET preamplifier for 220, courtesy of Kent Britain WA5VJB and *220 Notes* for August, 1985. The TI S-3030 is a relatively new device but should be available shortly. It is claimed to have 25 to 27 dB of gain with a noise figure of .5 to .7 dB. Impressive! See Fig. 5.

Coil specifications are as follows: L1, 5 turns, 3/16" diameter. L2 is identical but tapped at 1-1/2 turns from the feedthrough-capacitor end. C2 is a 10-pF trimmer. The entire unit can be assembled on a piece of G10 board with the foil side *up* using standoffs, feedthroughs, and piston trimmers to support the components. One thing to remember is that GaAsFETs are susceptible to high rf fields! It's best to use some sort of sequencing device and make sure that the power to the preamp and relay drop out before the 220 transmitter and amplifier are energized, otherwise you'll have a barbecued GaAsFET. A simple way to avoid this problem is to use two feedlines—one on transmit and one on receive—and employ a tower-mounted SPDT relay, such as a Dow Key or similar model. The relay should be energized in the receive mode and de-energized in the transmit mode. This will ensure that your investment in a good preamp survives your operation habits. One additional benefit of this method is that when you shut your station down, the mast-mounted preamp is taken out of the line, so that lightning or other hostile forces of nature don't send the preamplifier to an early grave.

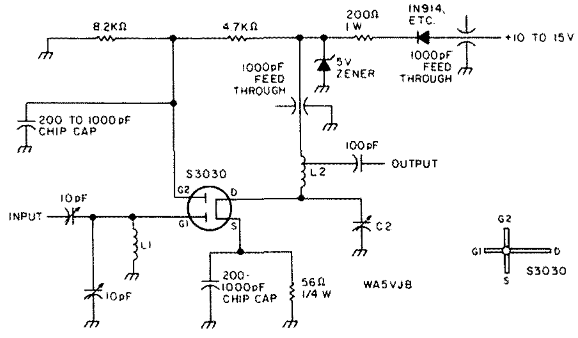


Fig. 5. A 220-MHz preamp using a TI S-3030 GaAsFET (courtesy of 220 Notes).

A typical noise figure for a 220 receive converter or transverter is likely to be about 2 dB or so. Using the GaAsFET on the tower may be worthwhile if your feedline run is 50 feet or more. Note that your S-meter readings will now be out of whack, as the idling receiver noise level might go as high as S7 or S9! A good way to correct for this is to obtain an in-line 10- or 20-dB attenuator good for UHF and microwave frequencies. I use two of them in my station: one at the receiver i-f output from my 432-MHz Microwave Module, correcting the S-meter readings back to S2 on receive when no signal is present, and one at the output of a 220-MHz MOSFET preamplifier to prevent overdriving the rf amplifier in my 220-MHz Microwave Module. Failure to add such a pad led to all kinds of intermod whenever I was beaming east towards New York City and channel 13.

These pads are easy to obtain. I bought five for 10 dollars from a local surplus house, and they are silver-plated with a female BNC connector at one end and a male BNC at the other. They show up at flea markets as well and can be useful for a variety of applications. One of the best applications is reducing the drive from a low-band exciter (such as the Kenwood TS-430S) to the associated transverter, cutting the output from 10 Watts to about 1 Watt. This is necessary when using a tetrode grid-driven amplifier. Don't put the attenuator at the output of the 10-Watt exciter or you'll blow it up. These devices are only rated for about 100 milliwatts or so of power dissipation.

Thanks to Dale Clement AF1T for his notes on converting the AM-6155. Thanks also to *220 Notes* for the preamp circuit.

CORRECTIONS

A few gremlins crept into OA4KO's article, "Toss Out Your Tubes," which appeared in the November, 1985, issue of *73*.

In Figs. 1 and 7, capacitors marked nF should be marked pF. Variable capacitors C1, C4, C6, and C12 are 1-8 pF. In Fig. 7, C7 is 500 pF.

HAM HELP

We are happy to provide Ham Help listings free, on a space-available basis. We are not happy when we have to take time from other duties to decipher cryptic notes scrawled illegibly on dog-eared postcards and odd-sized scraps of paper. Please type or print your request (neatly!), double spaced, on an 8½" x 11" sheet of paper and use upper- and lowercase letters where appropriate. Also, please make a "1" look like a "1," not an "l," which could be an "el" or an "eye." and so on. Hard as it may be to believe, we are not familiar with every piece of equipment manufactured on Earth for the last 50 years! Thanks for your cooperation.

I have a Radio Shack PC-2 computer with a cassette interface, printer, and RS-232C interface. Can someone give me advice on how to use this computer for RTTY or as a code reader? My HF rig is an ICOM IC-745.

Ron Frank K3WJL
1660 Sturbridge Drive
Sewickley PA 15143
(412)-366-6063 evenings

I'm looking for information about an IT805/GRC panadapter.

Jim Ashworth K4DSJ
Route 2, Box 218
Chunchula AL 36521

I need a manual for an Ampex SP-300 instrumentation recorder and an original R-390A manual. I'm also looking for an R-389, and I have R-392 parts available for just shipping charges (sorry, no tubes!).

Terry O'Laughlin WB9GVB
169 Ohio Avenue
Madison WI 53704

I am looking for schematics or a service manual for an HP AN/USN-105A oscilloscope.

J. Crockett
Route 2, Box 143
Walla Walla WA 99362

I need a schematic diagram or service manual for an Okidata Microline 82A printer.

Marvin Moss W4UXJ
Box 28601
Atlanta GA 30358

I need schematics and service information for a BC-1068 and a BC-1068/A receiver.

Elizabeth Sheehan
PO Box 246
Pembroke MA 02359

Does anyone have any ham-radio programs for the Hewlett Packard HP87 or HP75 computer?

Dr. Len Fishman KC2EW
305 Halton Rd.
Dewitt NY 13224

I need service information and a schematic for an FDK 750-A 2-meter all-mode, made by Fuku Yama Electronics Co. Ltd.

Mark Edwards N8EGJ
3204 Walnut Street
Port Huron MI 48060

I'm looking for a set of relays for a Swan 1011, a manual for a Tempo S-1 HT, and accessories for a Kenwood TS-520.

Tony Byrum KA9VFN
2009 West 5th
Ottumwa IA 52501

I am looking for information on using an Apple II+ to receive weather facsimile.

De Alcorn KA6COE
741 East Grandview Ave.
Sierra Madre CA 91024

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

This is a crazy month. On the one hand, I have been planning the content of this month's column for months; we have been taking a look at the material you all have sent in about various computer RTTY programs. On the other hand, kind of a tradition has arisen with the December issue where we take a walk through the marketplace, so to speak. Then again, *73* blew my mind with the Silver Anniversary issue.

My sincere thanks to each and every one of you who named me, and I suppose this column, for the Silver Eagle award. To be so chosen means quite a bit to me and certainly speaks to the readership of this column, which many of you tell me is the first thing you turn to when your issue of *73* arrives in the mail. Then again, it is kind of startling to realize that this magazine has been published two more years than Johnny Carson has been on "The Tonight Show"!

Well, this month let's see what all of you Commodore users had to say. Now, I know that I am going to catch some flack for this, but I will look at both VIC-20 and C-64 programs together this month. From the letters I have received, it appears that many of you who are using one of these machines have used the other, also. Therefore, lumping seems appropriate.

I want to apologize ahead of time for not having some of the manufacturers' addresses this month. It seems that some of these folks do not advertise where I read, nor did the amateurs using the programs send in any specific information. So, some of what I pass along will be essentially all that I received.

Jerry Weihrauch K0HZI, in St. Paul, Minnesota, is using a C-64 computer with a RAK Electronics program. He states that it is very easy to use and that he was able to interface it to a DT-600 demodulator with an inverter chip and transistor. Sounds straightforward, and Jerry is happy with the setup.

By far, though, the great bulk of you seem to be using a select few RTTY programs. In no particular order, let's see what some of you have to offer up.

Kantronics, a company whose name I should have in a one-key macro on my word processor, puts out a program called Hamtext for the Commodore computers. One of you felt that "the Hamtext package is absolutely first rate. [Don't] bother with Hamsoft at all, for it pales by comparison. Hamtext features ten message buffers that can be any size, a type-ahead transmit buffer that defaults to 256 bytes but can be set to any size, automatic insertion of the time of day, automatic return to receive, and diddle mode.

"The sense of the RTTY signal can be inverted on both transmit and receive, independently. Auto CR and auto LF can be enabled or disabled. The software will also transmit text files directly from disk or tape. The buffer area is partitioned among the message buffer, the transmit buffer, and whatever is left over is given to the holding buffer which stores all transmitted and received text on a FIFO basis.

"On the C-64 approximately 30K of buffer is available, and approximately 3K on an unexpanded VIC-20. As an added bonus, Hamtext on the C-64 generates, with the internal C-64 sound chip, RTTY tones which are very close to the 2125- and 2295-Hz standard frequencies. Hamtext on the VIC-20 also generates tones, but because of the limited frequency resolution of the VIC sound chip, the tones are *not* suitable."

Another of you, also using this sofware, relates that in using the VIC, "the worst feature of the VIC for RTTY is that it cannot save to disk or tape while copying. This means that at least 16K of added memory is highly desirable to allow adequate receive buffer."

All is not golden, however, as one of you wrote, "the Hamtext plug-in module I trash-canned after the linear amplifier erased the ROMs. It had no shielding whatever." Oh, well.

Microlog's AIR-1 is another RTTY interface many of you have had experience with. One of you says that "the AIR-1 is a fine piece of equipment. It has a lot of desirable features; it is easy to operate and does not require a tape or disk drive to load. All in all it performs well. I do have one major complaint, and therein lies my problem.

"The AIR-1 is noisy. At least it is when used with my rig. When I turn on the C-64 without the AIR-1 installed there is a very slight increase in background noise. The noise is barely perceptible and does not cause the S needle to move. However, when I have the AIR-1 cartridge in place and turn on the computer, the S needle jumps between 1 and 2 units. It is really noisy! I have tried any number of things including .001-uF caps on all connectors and passing the shielded cable through a toroid coil. Nothing has had a significant impact on the self-generated noise.

"The end result of the noise is that I cannot work the weaker stations. That is not serious, just frustrating."

Of course, those long lists of ice-cream flavors are there because we all have different tastes, and the same goes for RTTY terminal programs. Another of you liked the AIR-1, and added that although it did not come equipped for transmitting 850-Hz shift, Microlog was very helpful in making the modification.

And then there's the AEA CP-1. You see, there again the opinions fly. Another helpful company is credited with adapting this device to transmit the 850-Hz signal (required by some services) that it does not normally transmit. On the noise front, the affected station noted that "there was none of the self-generated noise. It was quiet. What a pleasure to use."

In general, it would appear that all of these units provide a good interface for the ham wanting to put his VIC-20 or C-64 on RTTY. Each has features and options that make it slightly different. If you look around, you can find folks boosting or burying each of them. Good luck, and I will keep you posted on whatever else I hear here.

My thanks to all the others who sent in information on their systems: David Reasoner N4KTY, in Huntsville, Alabama, Billy Nielsen WB4APC, in Radcliff, Kentucky, Cdr. William Radican N7CAD/KA2WR, and Robert Smits VE7EMD, in British Columbia. Always appreciated, folks.

Okay, get your walking gloves on as your fingers stroll along *73* Boulevard, the finest shopping district this side of Radio Row. If you don't get that reference, look up someone in QCWA and ask for an interpretation. Once again, it is time for our annual search for the RTTY goodies on sale in the pages of the October issue of *73*.

We are going to ignore transceivers and the like (although I know that you need those for RTTY, too) and just look for RTTY-specific manufacturers and dealers. We hit paydirt on page 8, with an ad from ege, inc., featuring many of the RTTY packages mentioned above. They have the cryptic "CALL" for some items instead of a price, so maybe you can haggle. Try their toll-free number, 1-800-336-4799, and take a shot.

Page 25 features an ad from Micrology showing their AIR-1 mentioned above. I should note that Micrologi moved some time back, so some letters or the like may have been lost in the shuffle. Anyway, tell them that "RTTY Loop" sent you when you call or write them if you are interested in the AIR-1 or any other of their products. Their address is 18713 Mooney Drive, Gaithersburg MD 20879.

Buried in the Barry Electronics Corp. ad on page 43 is mention of all of those RTTY interfaces again. Still no prices, though. Hmm, this could be interesting if you're in the market. Drop them a note at 512 Broadway, New York NY 10012, and see what turns up.

Another one of our manufacturers, AEA, features their new CP-100 interface on page 55. Featuring all kinds of shifts, baud rates, and features, it looks like quite a little package. Anybody using one yet? AEA can be reached at PO Box C-2160, Lynnwood WA 98036. No, I don't know how they can do all that manufacturing in a post-office box, either.

A surplus dealer, H&R Corporation, features a cabinet for a Model 28 KSR Teletype® in the ad on page 59. Cheap, yet. I have no idea who would want one, perhaps one whose presently-owned one is all scarred up, but they might have other goodies. I guess a note to them at 401 E. Erie Avenue, Philadelphia PA 19134, might pry loose a "free catalog."

The Martin Company, operating out of another post-office box, advertises a box meant for TRS-80 Model III/4 RTTY on page 60. To date, no one has written that they are using this thing, but if you're interested, they are at PO Box 982, Marysville WA 98270.

Hey, AEA has another ad on page 87 (this one a whole page) to tell you about their ATU-1000 Advanced Terminal Unit. Enough features to knock your socks off—I guess, at a price to match! If you need this level of equipment, at least the ad looks good, and I am sure that AEA would be delighted to inundate you with information. Send a note to the same post-office box mentioned above.

Let's not forget MFJ, whose three-page ad appears from pages 91 through 93. There's plenty of interest to the RTTYer in this ad, including their MFJ-1224 RTTY interface. They have a toll-free number to call, 1-800-647-1800; give it a try.

Finally, Kantronics is showing their new Universal Terminal Unit in their ad on page 95. Another of the high-class new demodulators now available, this one may be just what you're looking for. I should think that a letter to 1202 E. 23rd Street, Lawrence KS 66046, should produce some results.

Well, more and more, I am impressed by the number of manufacturers catering to the growing RTTY market. Be sure, folks, when you contact these advertisers, that you tell them that you saw mention of their products in *73*'s "RTTY Loop." That is important to us—and to them, so that they can tell where that valuable advertising dollar is reaching the most readers.

I have received several pictures of RTTY shacks worldwide. Would you be interested in a "Shack of the Month" or some such? No contest, no awards, nothing like that, just a chance to see another ham's setup on a semi-regular basis. Let me know. If there is some interest, we will put it in.

I have been busy between the mail at the above address and CompuServe (75036,2501). If you are waiting for a response and too much time in your view has gone by, don't be shy. Drop me another note and tell me so. I do get behind now and then.

Next month we will look at a computer that has had its share of ups and downs. At one time there were a half-dozen magazines devoted to this computer. As I write this, I learn of the demise of the next-to-last one, which will merge with a sister publication soon. I do not think this reflects on the computer but on the publishing industry. Oh, which computer? If you haven't guessed yet, I'm not going to spill it. Just be sure not to miss next month's column.

LETTERS

QUALITY, NOT QUANTITY

I am not a ham, but I am working on it. My wish is to make my first "sked" with my father, W4HBK, on Christmas Eve.

In reference to Mr. Monte Stark KU7Y's letter in the June, 1985, issue of *73*, I have to agree with him on keeping the Morse-code portion of the amateur-radio license test. With Morse code as a way of separating the truly interested people from the "slobs" on the street, it can only mean a more quality person will be operating the *ham* bands, instead of some ex-CBer who could care less whose QSO he is interfering with.

Now I realize that there are "slob" types in the amateur field also, but how would you feel if the ham bands sounded like profane channel 19? How would you feel having one of those loudmouthed, no brained, toilet-tongued individuals polluting the airways while you are trying to instruct your wife or your children on proper procedures and radio etiquette?

Being the holder of a Restricted Radiotelephone Operator's Permit and being able to operate on the HF, VHF, and 26.626-MHz frequencies of the Civil Air Patrol has taught me to be a more proficient radio operator, and I appreciate the "clean airways" of the CAP. So those of you out there in amateur-radio country should sit back and reevaluate the goodness in keeping Morse code and the laziness of those who do not wish to learn it. Just because it works for other countries to have a no-code license does not necessarily mean it will work here in the States. As for *73*, well you guys keep up the good work. I truly enjoy my personal copy each month.

From a future Novice to all you old-timers, God Bless.

John E. Everest RR-387
Dugway UT

WAKE UP

We are in sorry shape, I fear. A casual chat with our Section Manager revealed that many amateurs in Nebraska are against the ARRL enhanced Novice privileges proposal, some adamantly so. If this is true throughout the US, I think we have big problems in that I believe this is just the attitude that will be the death of our hobby. Look at the numbers on page 9 of the August, 1985, *QST*. The numbers are *still* not in our favor.

One of the favorite arguments seems to be that the bands are crowded enough already. Oh, really? Has anyone tried operating the HF bands mid-morning on a weekday? People who work nights should be made a target of our efforts if there is a general feeling that the bands are too crowded. The bands certainly are not overpopulated most weekdays.

Some repeater operators are concerned about losing 220 MHz to Novices because they may have to find new territory for their control links. Yes, there are lots of repeaters. . .probably more than we need in many areas, although not in Nebraska. But if they could take away band privileges by state, they could easily revoke 220 here since the control links wouldn't even occupy a space of several kHz, let alone five MHz. We are not going to keep the band if we just use it for control links. We must get more people on the band one way or another. A space can be reserved for the control links by band plan, as is done now. Novices can respect band plans, too: They must on the HF bands and do.

As one who acquired Novice privileges when phone operation was permitted on 2 meters, I see no problem in once again permitting Novices to operate phone. This, as has been stated in League literature on the subject, is even less of a problem now since the Novice license is renewable. During my term as a Novice, the phone privileges were taken away. I have often wondered whether this is a contributing factor to the seemingly low number of hams who are my own age (32) or who were licensed about that time (1966).

It's time to wake up, folks. There will still be plenty of room for those of us who like to tinker and prefer CW and SSB ragchews. But we have a dual problem: Lack of population on the ham frequencies will lead to their loss and ultimately to the loss of the hobby; the lack of population will become worse if would-be newcomers are not interested in joining our ranks. This is the only real stab at a solution yet proposed and it appears to be one which has been given much forethought. Hams spoke out against no-code. Here is a compromise. Let's put away petty differences and get behind it for the continuance of our hobby.

Michael S. Lennen KD0EV
Omaha NE

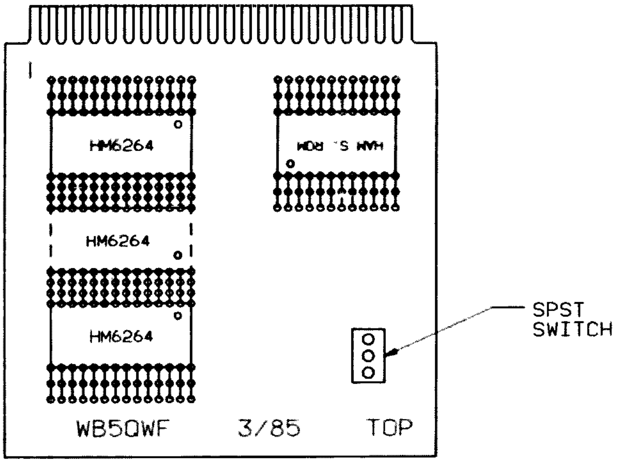
FLICK YOUR VIC

You might be interested in knowing that the VIC-20 memory expansion ("VIC RAMification: Part I," January, 1985) described in *73* can live in the same board and share expansion-port contacts with a ROM.

I bought my VIC to use as a RTTY machine and vowed not to get hooked on the computer capabilities, but I didn't like having to pull my Hamsoft ROM pack out of the expansion port to return to normal computer operation. I soon learned that I could turn off Hamsoft by applying +5 V to pin 18 of the 2732 EPROM, and I installed a switch to turn it off and on.

I laid out a board with two HM6264s and the Hamsoft memory on top and one HM6264 on the bottom, so they could share connections. I made a list of Hamsoft connections by tracing out the original board. A single-pole, single-throw switch was mounted on the board to select either the memory or the amateur program. To turn the memory on, +5 V is applied both to pin 18 of the 2732 and to pin 26 on each of the HM6264s. When Hamsoft is on, 2732 pin 18 floats rather than being grounded.

Andy Pickens WB5QWF
San Antonio TX



Switchable Hamsoft for your VIC-20. Note that the middle HM6264 is located on the reverse side of the board.

PROVE IT, PACKET

I've been reading about and listening to discussions on packet radio. Some seem to want to believe that it'll replace RTTY/AMTOR/CW/ASCII on all bands.

At a hamfest, one proponent of packet advised all those attending to "Get rid of your CW/RTTY/AMTOR gear now; by the end of the year packet will be the only mode used on those subbands, and you won't be able to even give away that other stuff." How he was able to say that with a straight face was rather amazing.

Personally, I don't believe packet will ever replace CW/RTTY/AMTOR, though it might have some uses; unless prices come down, it will remain as satellite communications has, strictly a rich ham's toy.

After all, why pay $500 and up for an interface capable of only one thing, when for half of that you can get an interface usable on four modes? It makes absolutely no sense.

At the same hamfest, another packet proponent declared, "Packet interfaces will be below $200 by the end of the year!", but he carefully failed to specify *which* year this miracle will happen.

As to packet being "error-free," I seriously doubt that it is, or will be, even on 2 meters and above. Remember—AMTOR was claimed to be absolutely error-free and I think that was proven wrong later on.

Another thing that's overlooked is the bandwidth used by packet. At 25 wpm, CW is about 100 cycles in width. So at 300 baud, packet is about 1200 cycles in width. And, at the speed packet keys a transmitter, wear on the relays is severe.

If, and it's a huge if, packet can be made affordable to the average ham, it may survive, but as long as it remains as it is now, a rich ham's toy, then it won't have much chance of survival. How many readers remember "narrowband voice modulation (NBVM)," which was supposed to do away with SSB around 1978? Unless something happens, packet will go the same way.

Getting back to satellites for a moment: It's always amused me to read that it only takes about 200 Watts erp to access OSCAR 10. If that's so, how come whenever you see photos of a station's antennas they're always running 25- or 30-foot dishes or stacked 12-over-12 arrays?

Gary Payne KE6CZ
Fresno CA

DISK DOPE

I read your article concerning diskettes ("Give Your Disks a Physical," October, 1985) and wholeheartedly agree with your observations. The best diskettes that I have seen through the microscope are Maxell. They have the smoothest surfaces and the best lubricant. 3M appears to be a middle-of-the-road product as far as surface quality is concerned. Verbatim is nothing more than 3M quality. Dysan appears to be the same thing as 3M but with a better polish. I confirmed that the Dysan raw material is in fact procured from 3M. Some of the bargain diskettes tend to vary greatly from box to box and, in fact, from disk to disk. The old adage, "You get what you pay for," is certainly true with diskettes. Very good article.

Bob Hill W4NIM
Cedar Rapids IA

REVIEW

HY-GAIN 205B-S ANTENNA

If there's one thing you soon realize after making your first contacts on VHF, it's the need for some kind of gain antenna. It can be a collinear, a 5/8-wave, an extended J, or a zepp, but whatever the choice, the message is clear: Unity-gain antennas are fine for local or repeater work, but they won't cut it for weak-signal or long-haul FM simplex.

One of the classic solutions to this problem is the yagi or beam antenna. With this type of antenna, a resonant dipole is used on a common boom with several parasitic elements which take the dipole's signal and direct it toward the station you wish to transmit to. The parasitic elements essentially take the signal from the dipole and combine it into a "beam" of radio-frequency energy so that rather than radiating and losing energy in two broad lobes, that extra rf is collected and used efficiently in one direction.

Enter the Telex Hy-Gain 205B-S five-element, 2-meter beam. It is an antenna which should prove valuable in FM-simplex as well as repeater work. It also provides a noticeable increase in system efficiency when you move from your vertically-polarized, unity-gain VHF antenna. Suddenly, signals which were hash are readable, and distant repeaters which were barely there are a solid S3.

To be certain, the 205B-S isn't the world's highest gain VHF antenna. Although it boasts a respectable gain (9 dB), there are specialized 11- or 15-element antennas with reflector arrays which have far more gain. Still, for the average FM operator this antenna should be more than enough.

When you first open the 205B-S box, the first thing you notice is its size. The boom is 75 inches long, which is quite a bit for an end-mounted antenna. You also notice the quality of the materials used. Although the boom and antenna elements are aluminum, the rest of the antenna parts are stainless steel, which should ensure long life. It will also make this antenna virtually maintenance free.

Assembly of this antenna is quick, thanks to the quality of the instructions. Although the written instructions are quite cryptic, Telex Hy-Gain uses very detailed exploded views of each section of the antenna, and just by using those views you'll have no trouble putting the whole thing together. It took less than an hour at N1BLH to have it assembled and ready for checkout.

About the most troublesome part of the assembly process is the beta match. You see, rather than using a gamma match to bring the antenna into resonance with 50-Ohm coaxial cable, Telex Hy-Gain uses a beta match and coaxial matching transformer. Actually a folded dipole, the driven element presents a basic impedance of 200 Ohms, which must be transformed to 50 Ohms. The coaxial balun handles this. If you can find 200-Ohm transmission line, you can feed this antenna directly, but you'll still need some kind of matching device to keep your rig happy.

To assemble this matching system (after you've assembled the dipole), you must first place the U-shaped beta rod on the dipole's elements. Then tighten it to the boom with a small clip and self-tapping sheet-metal screw. When this is

done, you then take the balun and attach it to the beta rod. You then attach your coax directly.

I know this sounds simple, and it is fairly straightforward, but like many straight roads in life, this one has some curves. First, there is no provision for an SO-239 female connector. You must attach the shield and center conductor to the same studs as the transformer assembly. I found the best way to handle this was by attaching solder lugs to the shield and center conductor, as Hy-Gain has done with its balun. When this setup is finished, you are advised to weatherproof the entire assembly. Using a lacquer such as Krylon will make short work of this.

This weatherproofing is mandatory. If you ignore it you'll soon find the performance of this antenna going downhill because your coax will fill up with water. I used cable putty to handle this just to have the ability to quickly disassemble things if I had to.

And, although this method of matching an antenna is quite functional, it would be far easier using the gamma match which is favored by other manufacturers. Beta matching is especially limiting if you must take the antenna apart later on.

The rest of the assembly involves little more than sliding the antenna elements through eyebolts that are inserted in the boom and tightening them down. You must measure the elements to determine their proper position so the lengths are correct. But this is little trouble.

As I noted earlier, the boom seemed huge when compared to the four-element beam I have run at N1BLH. Where the former beam was spaced for optimum gain on a short boom (about 40 inches) with little thought given to optimizing the front-to-back ratio, the 205B-S uses spacing which both optimizes gain and front-to-back ratio. Spacing was about .2 wavelengths. My tests showed the antenna had about 18 to 20 dB of front-to-back ratio, so that most of the energy was concentrated in the direction in which the antenna was pointed.

Further testing showed that this is a broadbanded antenna. As I checked vswr readings, I found that the curve I had drawn nearly matched the one in Hy-Gain's literature. The best-case vswr was 1:1 at 146 MHz and the worst-case was 1.5:1 as I neared the band edges. The match was good for my normal FM operating frequencies at the upper end of the 2-meter band. However, since it was so broadbanded, I was easily able to move to the other end of the band for some weak-signal SSB and CW work.

And, when I checked the antenna's gain with another station about five miles away, I received a signal report of S9 + 40. I realize that the other station didn't have a laboratory-grade receiving meter, but the performance of the antenna was certainly impressive since I was only running 300 mW. It was even more impressive because the antenna was mounted on a temporary mast about 5 feet off the ground near some construction equipment.

Overall, I was favorably impressed with the antenna, with the exception of the matching system. I found it performed as advertised and it handled all the chores I called upon it to do.

A word to the wise for those contemplating this antenna: Be aware that although the antenna is lightweight, it still presents quite a load to the mast. Use a good 2-inch piece of steel pipe. In fact, the U-bolts supplied are meant for that size mast. The antenna can be mounted for either vertical or horizontal polarization.

So, for the operator looking for the step into the world of gain antennas, look at the 205B-S. It should work as well for you as it did for me.

Marc Stern N1BLH
Framingham MA

GLB PK-1 PACKET CONTROLLER

Packet-radio controllers offered today are of two types—"TAPR-compatible" and "not TAPR-compatible." A similar distinction is made in the modem industry between "Hayes" and "not Hayes." No one is saying that Hayes modems are better than non-Hayes modems, or that TAPR TNCs are better than non-TAPRs: They're simply different. The GLB PK-1 TNC (Terminal Node Controller) falls into the "not-TAPR" category.

Inside the PK-1

The PK-1 is small (5″ × 10½″ × 2″), and the reason is clear once you open the case. Inside there are only thirteen integrated circuits and about twice that many resistors, capacitors, and transistors. Compare that to the over 25 ICs and dozens of discrete components in the Heath HD-4040 (a TAPR clone).

The PK-1 uses a Z-80 microprocessor and the popular Exar 2206/2211 chip set as a modem. The board comes with 8K of ROM (read-only memory) and 4K RAM (random-access memory), and there are sockets provided for another 10K of RAM. With factory modification the PK-1 can handle byte-wide RAM, increasing the total memory to 64K (8K ROM and 56K RAM). I'll explain why this extra memory might be handy in a moment.

There are three external connections to the PK-1: two 10-pin edge-card connectors and a miniature phone jack for power (11 to 14 V dc at 200 mA). Power may also be applied to one of the edge-card connectors, P2, which takes care of the lines going to and from the transceiver. P1 (the other 10-pinner) handles the terminal interface. The front panel houses an on/off switch and a momentary-contact pushbutton for resetting the controller.

Interfacer

Connecting the PK-1 to your radio and computer is straightforward. You can buy ready-made cables from GLB or you can make your own at home. Either way, a word of caution is in order: P1 and P2 are identical plugs, and they are not keyed. Check them *twice* before you power up!

The interface from the PK-1 to your terminal is via a "modified" RS-232 protocol. I say modified because only one voltage rail is used; + 12 V dc is a mark and 0 V dc is a space. Many popular interfaces use this method to simplify circuitry and cut the parts count, and it seems to work just fine. Four RS-232 lines are supported: TXD and RXD (data in and out), RTS (request to send), and CTS (clear to send). A spare line, pin 9, is connected to + 5 V dc inside the GLB and can be used to power an optional RTTY interface board that allows you to attach your PK-1 to a standard Murray teleprinter.

Five signals go to and from your transceiver: receiver audio, transmitter audio, receiver squelch, push-to-talk, and ground. Audio levels to the PK-1 can be anywhere between 5 millivolts and 3 volts, and GLB recommends that you tap audio directly from the discriminator output. That's a good idea, since the result will be audio that has not been de-emphasized or otherwised processed. However, for the faint of heart (like me), audio from the speaker jack is OK. In fact, you can improve the audio quality from there a bit by installing a .001-uF capacitor in line with the audio wire. Transmit audio from the PK-1 is about 1 volt.

You won't need the squelch signal unless your packet activity takes place on a channel shared with voice users. The TNC looks for the presence of a tone to determine whether or not the frequency is busy. On an all-packet channel there's no problem—every signal has a tone. In some cases, such as a voice/packet repeater, you'll need to hook up the squelch line so that the TNC will know when voice communication is going on.

The push-to-talk line switches to ground when the transmitter is keyed. All of the rigs I've worked with use this convention, as does most of the gear around these days.

Operation

There's no denying it. The PK-1 takes some getting used to. The reason that the chip count is so low is that GLB has implemented in software what most designs do in hardware. This means that the processor is kept extremely busy—so busy, in fact, that a separation must be made between sending and receiving packets. You must enter and edit your text off-line, then input it into the PK-1. And the PK-1 won't display incoming packets until you tell it to. You might think that this would be awkward (and I must admit that I did at first), but it isn't. After using the system for a short time, you become familiar with the commands and techniques and it is as easy as anything else you've had to learn.

Connecting to another station is done as a series of steps. First, your station call must be entered using the SC command (if you specify your callsign when you order your PK-1, it will be permanently stored in the ROM). Next, set the destination-station call using the SD command. You can specify a digipeated route using SV. Finally, entering AC (automatic connect) will send a connect request to the station specified by SD, using the route described by SV. Once conversion is established, the PK-1 enters a "chat" mode. And this is when the extra memory I mentioned before comes in handy.

Here's the reason that you need an off-line editor to type your text: The PK-1 cannot handle incoming text at the same time you are typing. Faced with the choice between the character coming from the keyboard and the packet coming over the air, the processor will save the character at the expense of the packet. After all, the packet will be repeated until it is correctly received. GLB mentions that you could simply stop typing when you hear an incoming packet. That may work in some places, but here in New England the local channel is busy all day and all night—and my packets don't sound any different than anyone else's. Besides, who wants to listen to *BRRRAAAPPP-GGRRAKK* all of the time?

The solution, then, is to assemble your text off-line and let the PK-1 store incoming packets until you are ready to see them. GLB even has a program to do it, called CPK, which they can supply for a variety of computers. I've also seen several programs posted on the local PBBSs (packet bulletin boards). Incoming packets are stored in a buffer until you call for them. Buffer means memory, and you get 4K of it with the PK-1. The system uses 2-3K for packet storage, and this seemed to be plenty for casual conversations. If you plan any long missives or are one of those people who measures social status by the K, by all means fill up the available space in the PK-1 with RAM.

Digipeating

This is a thing that the PK-1 does *extremely* well. Like any TNC, it can digipeat packets, but the PK-1's design makes it very well suited to remote operation. This means that you can put this board up on a mountain or a tower and just leave it there. All that's required is to pull the PK-1's data-in line high. In this mode, no terminal is connected to the TNC—programming is done by connecting via packet radio. You can turn the digipeater on and off, change parameters, display the system's status, or whatever else you might want to do just as if the machine were sitting in front of you.

A "watchdog" circuit is available from GLB for use in remote digipeaters. The circuit monitors a square-wave output by the processor. If this signal is not present for 20 seconds, the watchdog will reset the PK-1, which automatically comes up in the unattended-repeater mode. This is an exceptionally good thing to have. The module doesn't cost very much and is guaranteed to save you a lot of grief!

Final Thoughts

Overall I was impressed with the GLB PK-1. At first I was intimidated by the sheer number of commands (81), but you really only use a handful of them. The rest are interesting to play with, and you can learn a great deal about data transmission just by fiddling with the various parameters and looking at the results. Using an editor to prepare text also raised my eyebrows until I tried it. I can't say that I love doing it, but I can say that I don't notice it any longer.

The documentation is more than adequate. Separate sections deal with computer interfacing and on-line operation, providing a quick "cookbook" description of how to get the PK-1 on the air. Once things are hooked up and running, you can turn to the extensive command descriptions to learn more than you ever wanted to know about how the PK-1 works. Everything is explained in easy-to-understand terms and nothing is assumed. A very nice touch is a command reference chart printed on the back cover of the manual, which lists commands by function. I copied this chart with a photocopier set for reduction and pasted the now-tiny aid next to the CRT of my Xerox computer.

So there it is. If you're looking for a superb remote digipeater, try the PK-1. If it's an inexpensive way to get on packet that you want, try the PK-1 (it sells for $200 assembled). The engineers at GLB took a look at amateur packet radio and at the available TNCs on the market and came up with a design that is unlike any other. It took real guts to market a product that wasn't merely a copy of an already-popular unit, and their gamble has paid off with the PK-1.

If you want more information, contact *GLB Electronics, Inc., 151 Commerce Parkway, Buffalo NY 14224.*

Perry Donham KW1O
73 Staff

WHAT DO *YOU* THINK?

Have you recently purchased a new product that has been reviewed in *73*? If you have, write and tell us what *you* think about it. *73* will publish your comments so you can share them with other hams, as part of our continuing effort to bring you the best in new product information and reviews. Send your thoughts to Review Editor, *73 Magazine*, Peterborough NH 03458.

Photo A. The SSB Electronics LT23S 1296-MHz transverter.

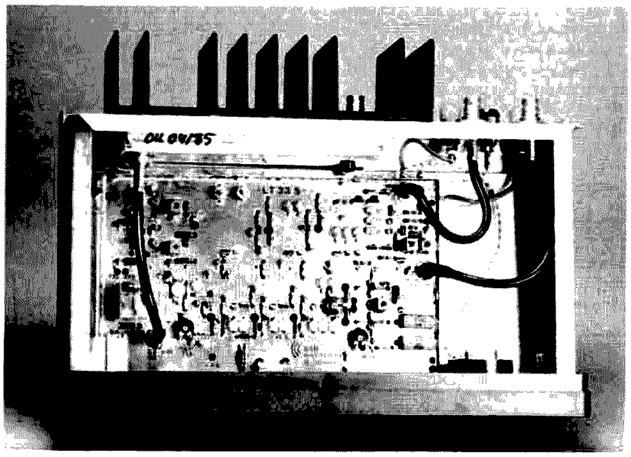


Photo B. Inside the LT23S (top view).

LT23S 1296 TRANSVERTER

The 1296-MHz amateur band, or 23 centimeters as it is frequently called, has long been a dark mystery to most amateurs. The logistics of getting something to oscillate at that frequency in a stable manner, as well as amplifying the resultant signal and modulating it, have served to discourage all but the most technically competent amateurs from ever operating on the band. Add the problems of designing a high-gain, low-noise front end, and the difficulties of getting all of this stuff to work with piles of interconnecting chassis and cables without a degree in electrical engineering, and you have the situation that existed not too many years ago on 23 cm.

With the advent of transverters using low-noise front ends and the reductions in chassis size made possible by solid-state circuits, 1296 began to be seriously considered by many UHF operators. There were still the problems with power, but even receivers with 5-dB noise figures could pull a weak, drifting CW signal out of the ether using a homemade disk constructed from chicken wire or door screening on an old TV antenna. Coffee-can feedhorns were the order of the day, and for the adventurous it was the loop yagi. A big step from the old days, but still not as convenient as a 144-MHz multimode transceiver.

Two developments have finally brought 23 cm down to earth for the casual operator: the Gallium Field Effect Transistor (GaAsFET) and new lines of high-gain (10-15-dB) power transistors for grounded-base operation at up to 3 GHz. It was inevitable that some manufacturer would marry the two in a high-performance 1296 transverter. What was surprising is that the manufacturer was from Germany—*not* Japan! Enter SSB Electronics of Iserlohn, West Germany, and the LT23S transverter.

At first glance, the LT23S is an attractive, functional piece of equipment. It measures 11¾" wide (30 cm) by 8¾" deep (22 cm) by 3¼" high (8 cm). The case is a hard aluminum shell with a plastic ring surrounding the front panel. A heat sink protrudes about 1¾" (4.5 cm) from the back panel.

The front panel contains the following controls: From the left, a switch selects either of two crystal i-f frequencies. The supplied crystal will downconvert the 1296-1298-MHz band to 144-146 MHz. Many serious contesters obtain a second crystal to shift the desired band segment up so that the conversion at two meters is now 146-148 MHz. This eliminates any possible feedthrough from strong nearby stations on 144 MHz during a contest. (In Europe, the two-meter allocation ends at 146 MHz, so shifting the conversion frequency up makes sense.) The formula for this crystal is detailed in the owner's manual.

Next is a transmit switch. This does exactly that and disables the receiver while setting the idling bias for the driver and final transistors. This function is paralleled by a rear-panel RCA-type phono jack. One merely grounds this jack and the unit goes into the transmit mode. The next switch is for power and controls the feed from the rear-panel dc connectors. Finally, there is a power meter that indicates output in Watts. On the rear panel, connections are made for input/output to a 144-MHz transceiver, 1296 receiver input from the antenna, and 1296 rf output (claimed 10 Watts across 50 Ohms). Three binding posts are supplied: dc input (13.8-14.5 volts dc), ground, and a second red post that supplies dc voltage in receive and cuts off while in transmit. This is to provide for a mast-mounted preamp if one is used.

All in all, the LT23S breaks new ground on 23 cm by offering the user a simple-to-use transverter. One merely adds an antenna relay, antenna, power, and multimode 144-MHz transceiver. The front end provides sufficient gain to work most signals encountered on the band, while the 10 Watts will carry a distance. That is, assuming the user has connected low-loss transmission line and a good gain antenna to the LT23S! Remember that conventional RG-8/U has about 10 dB of loss per 100 feet at this frequency, so something more along the lines of Belden 9913, ½" or even ⅞" hardline is in order. But having it all in one case instead of on 3 or 4 separate chassis with a myriad number of connecting cables can't be beat.

Now, on to the meat and potatoes of this review: How well does it work? The first LT23S sample made its way back from the VHF Shop in Pennsylvania as I was in the midst of frantically assembling a 432-MHz station for the Slide Mountain DXpedition (see the November, 1985, issue of *73*), and consequently it sat on the shelf for about 3 weeks until I was able to start making qualitative tests. One problem which surfaced immediately is that the on-board crystal oscillator drifted severely, to the tune of about 100-200 Hz per minute! This was unacceptable, and on-air tests with Tom Waldron KQ3R, the proprietor of the VHF Shop, convinced him that it was indeed galloping up the band.

Another unit was exchanged for the test unit and it, too, suffered from the same malady, and almost at the same rate! Subsequent conversations with the factory in Germany, Rick Connor WB2NPE, Ivars Lauzums KC2PX, and other LT23S users resulted in many solutions to the problem. Tom KQ3R suggested using a higher-grade crystal and said he will equip all models imported into the USA with crystals from International Crystal in Oklahoma. Rick WB2NPE suggested rounding the crystal case and shorting the unused crystal socket pins in the second oscillator together. Both mods worked, but the ultimate correction came via Ivars KC2PX through an unnamed amateur in Oklahoma, who removed the coupling capacitor from the unused oscillator to the first multiplier stage. *That* permanently fixed the problem, and I recommend to all LT23S owners the following modification:

The covers and inside board must be removed by loosening all screws around the case and panel on the front. This gives access to the underside of the mixer/i-f/switching board. Locate the 2.7-pF capacitor from the unused second oscillator and desolder it out of the circuit. Replace the cover and all will be well. Note that the supplied crystal is in channel 2, or "F2" as labeled on the front panel. The unit exhibits excellent stability (not measured) after this modification. Should you desire to use this oscillator again, merely replace the capacitor, or better yet, switch the crystal in the "F2" socket.

Photo B shows the main chassis layout. First-class workmanship is evident here. One unique feature of the LT23S is that unlike other transverters, you need not use an attenuator to cut down the drive from your multimode radio (assuming the maximum drive you are supplying is about 10 Watts). Two fixed-value resistors form a 50-Ohm, 10-Watt swamping network to "burn up" the excess power. For those using multimodes with adjustable output, I recommend turning the drive at 144 MHz all the way down to the minimum of 1 or 2 Watts. The swamping network will take care of the excess. A clearly marked potentiometer, "P IN," controls the drive level, and for your particular radio you should set this pot fully counterclockwise before applying drive. Carefully increase the sensitivity until the front-panel meter just about pins.

This brings us to a note regarding accuracy of that same meter: Using a Bird Model 43 wattmeter, 25-Watt 1.1-1.8-GHz slug, and Bird dry dummy load, the power measured when ten Watts was indicated on the LT23S was actually 8.5 Watts. This measurement was made using a 14-volt power supply, and when 10 Watts is actually measured on the Bird 43, the LT23S meter is pinned to the right. The sampling circuit in the LT23S uses an HP 2800 hot-carrier diode with a 50-Ohm terminated coupler. It's likely that the response of other 2800 diodes could vary all over the place, so it's not worth worrying about the accuracy of the meter. It is helpful as a relative output indicator, and if you are really a nitpicker, it could be recalibrated against a laboratory-standard wattmeter.

SSB recommends using a 14.5-volt supply for the transverter. How much of a difference does this make? With a 13.8-volt supply, maximum output was 7.5 Watts. At 14 volts, it was 8.2. And at 14.5 volts, it was indeed 10 Watts. That's how much! If you are using an external amplifier, the difference between 7.5 and 10 Watts might not cause much consternation, but if you plan on running the unit barefoot, crank the output on your supply up. Most commercially-made power supplies can easily be adjusted for higher output with an internal pot or zener between the regulator and ground.

The receiver front end was tested for noise figure using a Hewlett-Packard model 340A noise-figure meter. On this equipment, the noise figure turned out to be 2.0 dB. SSB claims 1.8 dB, so the measurements are close enough for government work, as they say. The HP-340A is about fifteen years ols and the discrepancy could exist there. It was not possible to measure the 1-dB compression point as only about −20 dBm of signal could be generated on the available test equipment. This is a very strong signal for 1296 and could be likened to working a station with about 1-kW erp about a half mile away, or closer. No detectable compression occurred at this point. Similar tests on other SSB 1296 preamps indicate the actual 1-dB compression point to be about 0 dB or slightly better, so I'll assume that is the case here.

Receiver conversion gain is specified at 24 dB. The measured value is 18 dB, which is adequate, but it would be nice to have the additional 6 dB or so, especially when using an older multimode or two-meter converter with a mediocre front end. In receive, the unit consumes 180 milliamps of current. When in standby, the value is 350 milliamps, and key down with 10 Watts it's 2.5 Amperes. So a small power supply of 3-4 Amps will do the job. Another note of caution: The final transistors, Phillips BLU99s, are *not* swr protected. Be careful not to abuse them by transmitting into suspect loads or unknown loads. They are not cheap to replace and not easy to come by. Under normal operation, an swr of 2:1 can be tolerated without difficulty.

Well! Enough of that. Let's shut off the signal generator, unhook the spectrum analyzer, and engage in some on-the-air tests. The LT23S performed admirably in the recent *CQ* WW VHF WPX contest,

where the NV6O/2 group netted 18 QSOs. In the ARRL September VHF QSO Party, 18 stations were also worked from this QTH. Reports were of exceptional linearity of the audio waveform, and listening to other LT23S users confirmed this. Speaking of which, it appears to be the hot setup around here in northern New Jersey, as nearly half of the stations I worked claimed to be using one! It doesn't take long for good news to spread, apparently. At KT2B, I use the LT23S to drive a single 3CX100, yielding about 70–80 Watts of output. This feeds 60 feet of 7/8" Spiroline and then drives 4 × 23 F9FT 23-cm yagis. The previous setup, using a Microwave Modules 1296/144 and SSB PA2510 amplifier, worked well, but the receiver in the LT23S gets the edge, as the noise figure in the MMT 1296/144 is about 2.5 dB or so. One confusing aspect was learning to wire the antenna relay backwards—that is, energized in "Receive" and out in the "Transmit" position. I had to remember to leave the power switch on, otherwise the amplifier went into standby with an idling current of 45 mA. A modified Dow-Key relay did the trick. The modification consisted of replacing the UHF connectors with type N, since I lost 1.5 dB on transmit using the UHF type!

The exciter in both cases is a Kenwood TR-9000, which has a fairly good front end but can scan memories and change frequencies at a very rapid rate. When I heard activity on part of the band, I programmed it into memory and scanned until I heard a station I needed during the activity hours. The LT23S does not have rf-detected switching and must be hard-keyed through the RCA jack on the back. A foot switch takes care of the problem, or you can use a keying jack on your multimode if it's there. I installed an internal reed relay in the TR-9000 and that did the trick. This was the way to go on 1296 during the contests! I had a ball with the LT23S and have one very minor complaint. The earth (negative) connection on the rear panel suffers from a condition where it comes loose and floats. You'll try making a secure fit with the power supply leads and go crazy. Apparently the binding post comes loose inside, and substitution of a typcial American-made post cures that problem.

All in all, a nice piece of work from *SSB Electronics*. The LT23S sells in the $650 price class and the sole US importer is the *VHF Shop, 16 S. Mountain Boulevard, Mountaintop PA 18707.*

Peter Putman KT2B
Morris Plains NJ

NEW PRODUCTS

MIDIAN ELECTRONICS DTCS-1 AND BTD-1

Midian Electronics has introduced two products for mobile radio service, the DTCS-1 DTCSS encoder/decoder and the BTD-1 Burst Tone Decoder.

The DTCS-1 programmable DTCSS encoder/decoder is compatible with Digital Private Line™, Digital Channel Guard™, Digital Quiet Channel™, and Digital Call Guard™. The DTCS-1 employs the 84 standard digital codes plus additional nonstandard codes and uses a 134-Hz turn-off tone.

The BTD-1 Burst Tone Decoder features operation over a wide input range. After a burst is decoded, a 2400-Hz tone alerts the user. Momentary and latched outputs are provided which will drive a horn, a call light, or some other indicating device.

For more information about either of these Midian products, contact *Midian Electronics, Inc., 2302 East 22nd Street, Tucson AZ 85713.*

ANTENNA SPECIALISTS BROADBAND VHF AMP

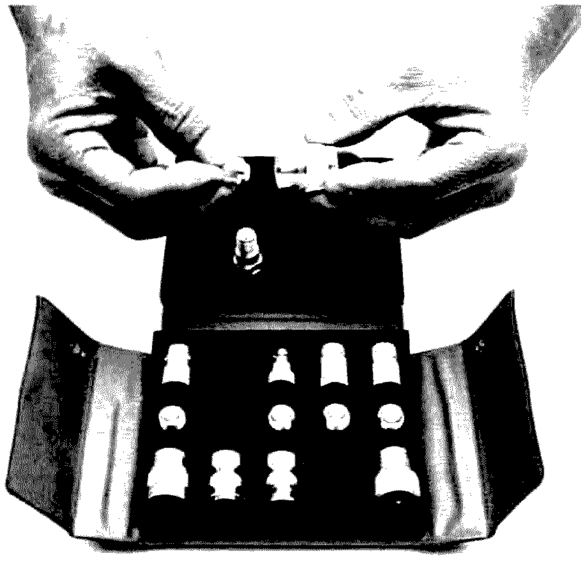
Antenna Specialists' new model ASA-3102-25 VHF power amplifier provides 50–115 Watts of output from 5–35 Watts of input between 150 and 174 MHz without tuning. The amp incorporates a low-loss T/R relay and is fully protected from dc-polarity reversal and high vswr. The unit has been type-accepted under FCC Parts 81 and 90.

For complete specifications, contact *Antenna Specialists Company, PO Box 12370, Cleveland OH 44112-0370.*

BIRD CONNECTOR ADAPTER KIT

Bird Electronic Corporation now offers a kit of precision 50-Ohm adapters which allows interconnection between any combination of four popular rf connectors. Included in the kit are one male and one female UHF, BNC, and TNC connector, as well as two male and female N connectors. Five couplers are included so that five complete adapters can be assembled at one time.

For complete information about this kit, contact *Bird Electronic Corporation, 30303 Aurora Road, Cleveland OH 44139.*


The Bird Rf Interseries Adapter Kit.

GRIPMATE ENTERPRISES OFFERS EXTRA HANDS

A new product from Gripmate Enterprises solves the "not enough hands" problem for hobbyists. The Gripmate consists of a base, which is clamped to the work table, and four adjustable arms, each of which carries an alligator clip. Two extra arms provide a 2.5× magnifying glass and a magnet for special jobs.

More information is available from *Gripmate Enterprises, Inc., PO Box 6179, Arlington VA 22206-0168.*

AEA PAKRATT™ PK-64

Advanced Electronic Applications, Inc., has announced the model PK-64 packet, RTTY, AMTOR, and Morse communications system for the Commodore 64 and C-128.

The PK-64 features an on-screen tuning indicator, split-screen operation with status indicators, disk, cassette, and printer capabilities, ten message/command buffers, text editing with block moves, a 20K QSO buffer, and a keyboard-selectable HF or VHF modem with pre- and post-detection filtering for improved signal-to-noise performance. Text received in one mode may be retransmitted in any other mode.

Features specific to packet radio include a connect alarm, connection with up to ten stations simultaneously, a date and/or time stamp for incoming messages or connections, a user-generated message for automatic response to connections, and a hardware HDLC for full-duplex operation.

For more information, contact *Advanced Electronic Applications, Inc., PO Box C-2160, Lynnwood WA 98036; (206)-775-7373.*

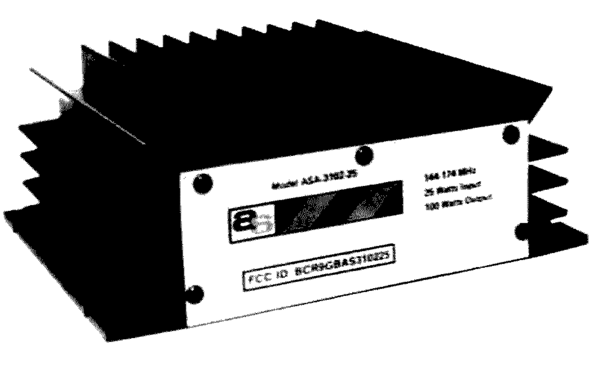
AMATEUR TESTCALM FROM TWIN OAKS

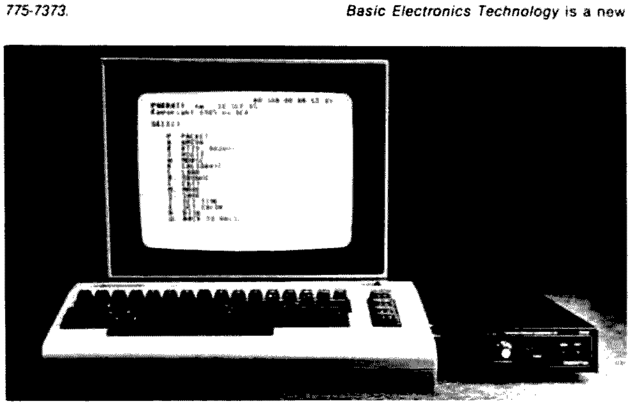
Amateur Testcalm is an anxiety-reducing audio cassette offered by Twin Oaks Associates. Developed by Dr. Thomas Linde KZØT and Dr. Michael Whiddon, Amateur Testcalm is intended to increase a student's attention, concentration, and data recall. The student hears simultaneous verbal and non-verbal messages designed to reduce apprehension and stress during amateur licensing exams.

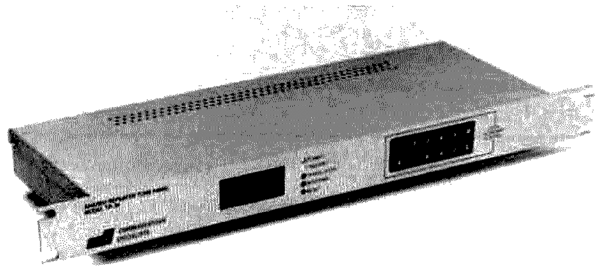
For more details, contact *Twin Oaks Associates, Rt. 5, Box 37, Knoxville IA 50138.*

TI ELECTRONICS REFERENCE BOOK

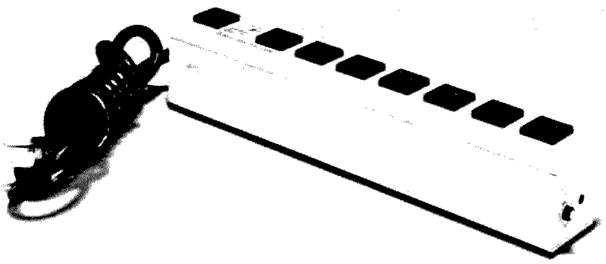
Basic Electronics Technology is a new


Antenna Specialists VHF broadband power amplifier.


AEA's model PK-64.



Communications Specialists' TP-38 Shared Repeater Tone Panel.



The Smart Outlet Box from Heath.

one-volume reference guide to semiconductor circuits and systems from Texas Instruments. The book explains how semiconductor circuits work in amplifiers, oscillators, power supplies, radios, TVs, and computers. Each chapter ends in a summary followed by a short quiz.

For more information, contact *Texas Instruments, Inc., PO Box 225474, MS 8218, Dallas TX 75265.*

CSI SHARED REPEATER TONE PANEL

Communications Specialists has announced the TP-38 Shared Repeater Tone Panel. Microprocessor controlled, the TP-38 provides all 38 EIA standard CTCSS tones to allow up to 38 subscribers. Built-in time and hit counters record the activity of all CTCSS tones on the repeater's channel.

The TP-38 has a low current drain, is suitable for battery- or solar-powered repeater sites, and is static- and lightning-protected. An LED display shows all received CTCSS tones received, whether they are active in the panel or not. An optional unit, the TP-DTMF, allows all control functions to be performed remotely with a 12- or 16-button touchtone™ pad.

For complete details, contact *Communications Specialists, Inc., 426 West Taft Avenue, Orange CA 92665-4296; (800)-854-0547.*

S-COM MRC-100 REPEATER CONTROLLER

S-Com's MRC-100 is a 6809-based repeater controller with 8K of NOVRAM and 16K of EPROM. Features include a polite CW identifier, CW messages with variable speed and pitch, an autopatch and reverse autopatch with mixed-mode dialing, a 200-number telephone dialing memory, DTMF and 5/6-tone paging, a CW clock and calendar, and programmable passwords for remote control.

The MRC-100 requires 8–15 volts at less than 300 mA. A diode-isolated automatic external-battery changeover input is also provided for emergency use.

For more details, contact *S-Com, PO Box 8921, Fort Collins CO 80525.*

HEATHKIT SMART OUTLET

Heathkit's Smart Outlet Box waits until a device plugged into one of seven sockets is turned on, then supplies power to it and the remaining six outlets. An eighth outlet is constantly on for units such as clocks which require continuous power. The Smart Outlet uses UL-approved surge protectors and power taps, and is available in either kit or assembled form.

To receive more information about the Smart Outlet Box and a free Heath catalog, write *Heath Company, Dept. 150-589, Benton Harbor MI 49022.* In Canada, write *Heath Company, Dept. 3100, 1020 Islington Avenue, Toronto, Ontario M8Z3.*

GLB PK1L PORTABLE PACKET CONTROLLER

GLB Electronics has introduced the PK1L, a packet-radio controller designed specifically for portable and solar-powered digipeaters.

The PK1L is entirely self-contained in a 4.6" × 5.9" × 1" shielded enclosure. The circuit includes an on-board CMOS Z-80A CPU, 8K of programmable memory, a preprogrammed 32K ROM, an RS-232 interface, and a packet modem. The system draws 25 mA and can be powered by solar cells or a 9-Volt transistor-radio battery. A lithium battery is employed for memory retention.

For further information, contact *GLB Electronics, Inc., 151 Commerce Parkway, Buffalo NY 14224.*

KENWOOD TH-SERIES ACCESSORIES

Two new accessories are available from Kenwood for the TH-series of pocket transceivers.

The PB-21H is an extra-life nickel-cadmium battery pack rated at 500 mAh (the standard PB-21 is rated at 180 mAh). It weighs 6½ ounces and is ½ inch longer than the PB-21.

The BC-6 is an ac-operated two-pack quick-charger which doubles as a dc power source for a TH-series radio. The BC-6 can fully charge either a PB-21 or a PB-21H in one hour. Also included is an adapter cable which allows the HT to be operated while the batteries are charging.

For complete details about these and other Kenwood accessories, contact *Kenwood-Trio Communications, PO Box 7065, Compton CA 90224.*

FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

AMATEUR TV

A few years ago, when the home-video craze began, I told all of my friends that we were on the verge of an amateur-television (ATV) boom. "Soon," I predicted, "we'll see ATV all over the place. It'll become so popular, we'll see a frequency squeeze so tight that it will make 2 meters look like the wide open spaces."

I was wrong.

What happened? Video equipment is cheaper today than ever before. In the late 1960s, a black-and-white videotape recorder cost about $2000. Today, I've seen *color* VCRs advertised for as little as $250. A color camera in the 1960s would have cost you a cool $50,000 or so. Today, you can get one for less than $500. All in all, you can get an ATV station up and running for under $700—antenna and everything. And that's with new equipment. If you're willing to scrounge around for used gear, you can probably get on the air for under $300, maybe even less.

So why hasn't ATV taken off? Perhaps it's for the same reason AT&T's Picturephone service never made it. Maybe hams just don't want to see each other's ugly mugs. Or maybe ATV is just suffering from the same malaise as ham radio in general.

But I think the reason is more fundamental. I believe the sort of people who are likely to be attracted to ATV are turned off by the code requirement. Think about it for a minute: learning Morse code to operate a VCR, camera, and TV transmitter. Sort of like being required to know how to tap dance before being allowed to drive a car. Totally irrelevant skills.

So ATV, like much of ham radio, languishes. In the meantime, I can enjoy the relatively vacant band space to show videos of my vacation to Europe, my trip to a vintage car show, the installation of my TVRO dish, and other activities to a few selected friends.

Still, it would be nice if I could find a few more people to bore.

ELEMENT 1
MULTIPLE CHOICE

1) The aspect ratio of a standard television picture is:
   1) three units high and four units wide
   2) four units high and three units wide
   3) one unit high and three units wide
   4) three units high and five units wide

2) Lighting intensity is often measured in:
   1) decibels
   2) lumen minutes
   3) brightness degrees
   4) foot-candles

3) The little red light found on top of most studio TV cameras is officially known as:
   1) a little red light
   2) an idiot light
   3) a cue light
   4) a tally light

4) The unit professionals use to transfer film images to video is called a:
   1) movie projector
   2) film-to-video adapter
   3) film chain
   4) kinescope

5) Which of the following *is not* a video pickup tube:
   1) vidicon
   2) plumbicon
   3) image orthicon
   4) image iconocon

ELEMENT 2
TRUE-FALSE

	True	False
1) A "Gen Lock" locks the synchronizing generators from two different video sources.	____	____
2) A "High Key" means a high-impedance signal.	____	____
3) "Head Room" is the space between a televised subject's head and ceiling.	____	____
4) The image iconoscope is still widely used in high-quality TV cameras.	____	____
5) The image orthicon is a highly sensitive video pickup tube.	____	____
6) Lens focal lengths are usually measured in inches.	____	____
7) A floodlight emits undiffused, directional light.	____	____
8) A "halo" is a dark flare around a very bright or reflecting object.	____	____
9) One "pans" a camera up and down.	____	____
10) "Slant track" scanning is the same as "helical scanning."	____	____

ELEMENT 3
SCRAMBLED WORDS

Unscramble these words relating to ATV:

maarec	omognilb
caleminun	klupcp
apet	doeiv
noastrct	siiletevno
cyns	tsnesrhgib

ELEMENT 4
FILL IN THE BLANK

1) An undesirable double image is a ____________.
2) A mirror-like device that singles out red or blue light is a ____________ filter.
3) A gradual transition from one picture to another where the pictures briefly overlap is called a ____________.
4) A fluorescent light is also called a ____________ light.
5) Fading a picture is also called "going to ____________."
6) Commercial TV transmissions have a ____________-line resolution.
7) TV audio is ____________-modulated.
8) Commercial TV has an audio subcarrier that is ____________ MHz above the picture carrier.
9) TV video is ____________-modulated.
10) Perfect ATV reception is often referred to as ____________-____________ copy.

THE ANSWERS

Element 1:
1—1, 2—4, 3—4, 4—3, 5—4.

Element 2:
1—True Prevents picture rolling.
2—False High-intensity lighting.
3—False Top of the TV screen and subject.
4—False The iconoscope hasn't been used for years.
5—True Very sensitive.
6—False Usually in millimeters.
7—False Diffused, non-directional light.
8—True Most evident when using a cheap camera.
9—False One "tilts" a camera up and down and "pans" it from left to right or right to left.
10—True Commonly used on VCRs.

Element 3:
camera, contrast, video, luminance, sync, television, tape, blooming, brightness, pickup

Element 4:
1—ghost
2—dichroic
3—dissolve
4—cold
5—black
6—525
7—frequency
8—4.5
9—amplitude
10—closed-circuit

SCORING

Element 1:
Five points for each correct answer.
Element 2:
Two and one-half points for each correct answer.
Element 3:
Two and one-half points for each correct answer.
Element 4:
Two and one-half points for each correct answer.

How did you do?
1-20 points—You're out of focus
21-40 points—You're a longshot
41-60 points—Only slight signal distortion
61-80 points—Armchair copy
81-100 points—An instant replay, please

BE MY GUEST

Guest Editorial by Ted Harris N6IIU

REACH OUT AND SERVE SOMEONE

We hams pride ourselves on being trained communicators, but how many of us are really using that training for the maximum benefit of our communities? It's not enough for a few hams with handie-talkies to just suddenly show up at a public-service event or a disaster. If we really want to serve, we have to get actively involved in showing civic leaders what communications capabilities we can offer, for routine local festivities as well as emergencies.

Better yet, we should show them how they can most effectively use all the communications resources available to them. Radio amateurs—and especially the local emergency coordinators—should be telecommunications managers. We should be familiar with all of the radio assets available to a community, not just the hams, ham equipment, and ham frequencies. Sure, this means more work for us, but it means we serve our cities better and feel prouder of our contribution.

Coordinate All Resources

Many of us are working actively with our communities in disaster planning, but there are plenty of other times throughout the year when we can acquire valuable experience and simultaneously demonstrate our expertise and willingness to help. Whether you're planning for a parade or a natural disaster, don't depend on others to figure out what your ham group can do. Find out all you can about the event and how your city handles it, then suggest specific ways in which you can help.

For instance, would it be helpful to have packet radio to send the correct order of participants to a parade announcer? Hams on bikes or motorcycles for easy access through crowds? ATV in a plane during a forest fire? Remember, some of these may need to be done off the ham bands, on government or business frequencies. A combination of city, ARES, and REACT resources might provide the perfect solution. Advance planning will give you time to get the necessary clearances and equipment.

When you're outlining your capabilities to non-hams, don't just list the equipment you have available, describe its capabilities. Instead of saying, "We have twenty operators who have synthesized radios equipped with DTMF encoders," explain that, "We have twenty trained people who can take their hand-held radios anywhere you need them. They can use the radios to relay information among your people at those remote sites or back to your headquarters. They can transfer messages between your agency and others. They can also direct-dial local emergency services from the field or, in some instances, call any telephone number you want."

Keep Up on the Latest Technology

It's vital that amateurs who want to serve their communities keep up with current technology. In these days of inexpensive portable equipment, it's inexcusable to show up at a disaster with a crystal-controlled two-channel radio that only runs on ac! Encourage your community's emergency agencies to have state-of-the-art equipment also. Ask them to provide funds for the purchase of amateur-radio equipment. It's surprising how much money is available in city and county budgets or through state or federal grants for such purposes if you just look for it.

At the very least, ask them to buy antennas that you and other local hams can install in locations that will be vital during a disaster. In the San Francisco Peninsula area where I live, for instance, hundreds of antennas (including coax runs to convenient radio setup sites) have been installed in schools, hospitals, Red Cross offices, forest service headquarters, fire and police departments, as well as in city and county emergency operations centers.

Along the same lines, look for ways to support your local agencies with sophisticated communications they can't afford. For instance, ask your local amateur-television aficionados to provide fast-scan TV between a disaster site and police, fire, forest service, etc., headquarters. The same goes for packet radio. Few communities can afford their own packet systems, but by taking advantage of local hams, they can have this valuable medium available to them.

Utilizing new technology to the fullest

also means you'll be able to bring into the public-service fold many hams who would otherwise feel they have nothing to contribute. Hams who can't send 25-wpm code can perform a tremendous service by sending traffic via packet radio. Hams who are housebound or don't have portable equipment can act as relay stations between two or more amateur-radio emergency nets.

Your job as an emergency coordinator is to facilitate communications, offering your served agencies a wide variety of communications methods to manage the disaster more efficiently. Find what niche each group of hams can fill, and put them in charge of it. Be creative in utilizing the amazing variety of skills that radio amateurs can offer.

Train Everyone

Just as important as coordinating equipment is training the people using it. Whole books could be (and have been) written on this, but let me review a few points: For instance, we probably all need a reminder from time to time about keeping net communications brief and to the point. When providing communications, restrict the traffic to that actually needed to support the agency. Resources, logistics for amateurs, and the like can be handled on other channels.

Too often we hear hams talking to hams about non-disaster-related topics, tying up the frequency and making a bad impression on the agencies who are depending on us and the news-gathering people and citizens with scanners who may be listening in. It's surprising how many more people can participate on a single channel once we get down to the essentials. Try listening to your local fire channel for a while—you'll quickly understand how they can manage 30-50 radios at once during an emergency!

Incidentally, teach your hams not to be afraid to let go of the microphone once in a while. Complicated questions and answers between agency personnel can best be handled by letting the people involved talk directly to each other. It's perfectly feasible to do this while maintaining the legally required control over our equipment. Despite our training in passing traffic, there's no reason to add another person to the information flow if it's not necessary. Communications improve, agencies have more participation in the disaster-management activities, and they reach a new appreciation for us that results in more requests for our services.

Also, make it clear to your hams that they must take an active role in offering their help during disasters, even once they're at their assigned location. I've seen amateurs assigned to a shelter sit all day doing nothing, simply because they didn't let the people in charge know what services they could provide. High turnover both among the amateur operators and the agency people (such as shelter personnel) mandates constant reminders of the hams' presence and capabilities.

You can also provide a great service to your community by being willing to train non-hams in the use of radios for community events and emergencies. We hams have lots of experience in using radios. Don't be stingy with it!

If there's a major local event coming up, ask the organizers to let you give a training session a couple of weeks in advance. At the workshop, you can demonstrate how radios work and mention things that might go wrong (like the signs of battery failure). Show people how to speak properly into the microphone and give them hints on how best to identify themselves and to call others. Remind them to use plain language, to be succinct, and to avoid needless chatter.

Any time you're working with neophyte radio operators, think of ways you can "foolproof" the operation of the radios. For example, at the 1984 Olympics at Stanford University, we covered the switches of the handie-talkies with duct tape so they wouldn't get knocked into the wrong positions. We also put a sticker on each radio listing the frequencies used by each group (medical, security, etc.).

Besides teaching non-hams about radios, don't forget the opposite side of the coin: learning about *their* jobs and needs. For instance, I recommend that hams (especially emergency coordinators) take Red Cross shelter-management classes. Not so you can run a shelter, since your strength during a disaster will be keeping the radios going and the information moving. But if you're ever assigned to a shelter during a disaster, you'll better understand the needs of the people running it, so you'll be able to communicate those needs more effectively. In a nutshell, you'll be more helpful—and that, after all, is the bottom line of amateur radio.

A Real-Life Example

Here on the San Francisco Peninsula, we had a great opportunity to put this proactive philosophy to work during the 1984 Olympics. For ten days, Stanford University hosted soccer preliminaries for the XXIIIrd Olympiad, and among the many hardworking volunteers were eleven hams working for the Technology Group.

Our overriding attitude in approaching this assignment was, "We're here to help." Weeks before the games began, we were assisting Technology Manager Chris Veal with his planning. I attended as many coordination meetings (both before and during the Games) as I could, looking for ways we could help.

In at least one case, our early involvement headed off a communications disaster. Not long before the games began, we discovered a problem with the commercial hand-helds due to be shipped up from Los Angeles. In southern California, the frequencies assigned to the Los Angeles Olympics Organizing Committee (LAOOC) for security and administration were going to be clear during the games, but here in the Bay Area they are used heavily by local news-gathering agencies!

The manufacturer who was supplying the radios to the LAOOC didn't have time to recrystal them for different frequencies. So we swung into action up here, got permission to use some government frequencies, found some radios that would operate in that band, and ordered 75 of them. At the end of the Olympics, they were sold off, making the total cost nearly the same as renting would have been.

Had we just sat back and shown up the first day of the Games with our communications van and waited for a terrorist attack, the Olympics communications might have been in shambles, and we would have missed a tremendous opportunity to help.

During the course of the Games we sought out and were called upon to help with many other tasks, which we gladly handled. Most were related to telecommunications, but if we had a spare person we were happy to help even with ones that weren't. We didn't want to adopt a "we only do electrons" attitude. Our flexibility paid off in the respect we got from Olympic organizers—and more importantly, in the pride we felt at our participation.

Act As Community Advisors

If you've still got time and energy left after planning and supervising communications for your town's big events, there's yet another way your expertise can help.

A lot of cities—especially smaller towns—can't afford telecommunications consultants, so they rely for advice on manufacturers' salespeople. You, on the other hand, can be an unbiased consultant. Just make sure you stay levelheaded: This is not the place to grind axes about antenna ordinances or cable-television interference. Once they trust your opinion, you'll be able to address those problems calmly and rationally—and with more friends in high places on your side.

Overall, local hams are going to be better informed than most people on what communications equipment is on the market, what technologies are being tried, and which ones are working. Your expertise can help your town make better-informed decisions on the purchase of emergency communications equipment, or on cable-television franchising.

Your electronics knowledge can also help prevent RFI problems during local events. Many committees have summer-time air shows; local hams can work with the FAA and FCC to make sure ground-based radio activities don't interfere with the airplanes. In fact, whenever multiband frequencies are in use, you should check to make sure they don't interfere with each other, or with broadcasting equipment.

Get Involved

If there's one message I could leave you with, it's this: Get involved. Take an active role in planning communications for your community. Don't sit at home waiting for someone to figure out what you do and what needs doing. When you're on the scene of a disaster, show initiative. Don't just show up with a "cordless phone" and a warm body.

Make yourself valuable to your community by becoming a telecommunications expert. Keep up on the latest technology so you can choose the best equipment for every communciations need.

If you're an amateur-radio emergency coordinator, know your people and what special talents they have. Who should be assigned to work with the schools? Who with industry? Who with the fire or police departments? Who with the press?

What do we hams get for all this hard work? Self satisfaction. Knowing that we've learned more and contributed more. You're a unique individual, with many more talents than just pushing a microphone button. You have special talent, skill, and aptitude that will make you valuable to your community.

Extend yourself beyond the attitude of, "Okay, I'm here with my radio; tell me what to say." Reach out, find out what people need, and serve those needs. Everyone has a contribution to make; it's up to each of us to find out what that contribution is and make it.

Ted Harris N6IIU is Disaster Services Director for the Palo Alto (California) Area Chapter of the American Red Cross, and Amateur Radio Emergency Service (ARES) Emergency Coordinator for Stanford, California.

SATELLITES

USING THE AO-10 APOGEE PREDICTIONS

Apogee predictions for the month of December are provided for three sections of the United States: Washington DC at 39N 77W, Kansas at 39N 95W, and California at 38N 122W. Times are in UTC and apogee in this case is mean anomaly 128 rounded to the nearest whole hour. Use the chart as a guide in aiming your antenna, then fine-tune the azimuth and elevation values to peak the satellite's beacon signal. If you require more accurate orbital predictions, contact AMSAT at PO Box 27, Washington DC 20044.

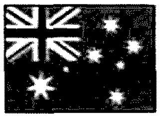
AMSAT-OSCAR 10 APOGEE PREDICTIONS
DECEMBER 1985

			WASH		KANSAS		CALIF	
ORBIT	DAY	TIME	AZ	EL	AZ	EL	AZ	EL
2187	1	2100	140	7				
2189	2	2000	131	1				
2194	5	0600					231	1
2196	6	0600					226	3
2198	7	0500					218	9
2200	8	0400			230	0	209	15
2202	9	0400			225	3	202	16
2204	10	0300	230	0	217	9	192	19
2206	11	0200	223	6	207	14	181	20
2208	12	0200	217	8	201	15	174	19
2210	13	0100	208	13	191	18	163	18
2212	14	0000	198	17	180	19	153	15
2214	14	2300	187	19	168	19	143	11
2216	15	2300	181	18	162	16	139	6
2218	16	2200	169	18	152	13	130	1
2220	17	2200	163	16	147	10		
2222	18	2100	153	13	138	5		
2224	19	2000	144	9	130	0		
2226	20	1900	135	4				
2228	21	1900	131	0				
2233	24	0500					229	0
2235	25	0400					221	7
2237	26	0400					216	9
2239	27	0300			228	0	206	14
2241	28	0300			223	3	200	15
2243	29	0200	228	0	215	9	190	18
2245	30	0100	221	5	205	13	179	19
2247	31	0000	212	11	195	17	168	18

73 INTERNATIONAL

Each month, 73 brings you ham-radio news from around the world. In this collection of reports from our foreign correspondents, we present the latest news in DX, contests, and events, as well as keep you abreast of the technical achievements of hams in other countries.

If you would like to contribute to your country's column, write to your country's correspondent or to 73 Magazine, Pine Street, Peterborough NH 03458, USA, Attn: International Editor.



AUSTRALIA

J. E. Joyce VK3YJ
44 Wren Street
Altona 3018
Victoria
Australia

VK4 RTTY GROUP

The South East Queensland Teletype Group recently held a seminar in the Communications Building of the South Brisbane TAFE College, the main aim being to introduce interested amateurs into the RTTY mode of operation. The seminar covered most subjects on RTTY from very basic topics to the writing of the most complicated computer programs for RTTY and was deemed a great success by all who attended.

The introduction to the seminar was given by the president of the SEQTG, Doug VK4ADC, who also lectured on the modulator/demodulator requirements and design and AMTOR with store and forward repeaters. Other subjects covered were: computer software for RTTY, Siemans 100 teleprinters (technical), packet radio, the Teletype™ Models 14 and 15 (practical), and modem tuning (practical).

The SEQTG is probably the most active RTTY group in Queensland (VK4), with a large reference library on both mechanical and electronic data on RTTY. They also have a 2-meter repeater located on Mt. Cotton (near Brisbane) for both data and voice, plus for RTTY DXers a weekly news service transmitted on 7.035 MHz each Monday night at 1000 UTC. For anybody wishing to know about RTTY activities within Australia, I could suggest nobody better than the SEQTG, PO Box 184, Fortitude Valley, Queensland 4006, Australia.

SOUTH AUSTRALIA—VK5

The state of South Australia, like Victoria, is a very young state, considering that we as amateurs talk to countries that have histories that go back thousands of years. We as Australians are proud of our history, nowever, and to us, celebrating 150 years of statehood is a big event.

So, 1986 for VK5 is a time to celebrate statehood, with special events starting in 1985. The official launch of S.A. amateur-radio communications took place during the week 27th May-1st June, in support of the WIA (S.A.) Jubilee 150 celebrations. The launch was from the Renaissance Center in the Rundle Mall, the center of Adelaide.

A week's program of worldwide communications was used to demonstrate, with display material, as many modes of communication as possible, including HF, CW, RTTY, ATV, and satellite. Three operating locations were used: a mobile radio van, a radio rental shop's ground-level window, and the spacious restaurant on the 6th floor of the Renaissance Center. The restaurant has a commanding view of the suburbs and the hills overlooking Adelaide and, therefore, is an excellent point of contact from which to work.

The purpose of the activity was to promote S.A. in advance of S.A.'s Jubilee 150th year, to highlight its birthday year, to promote activities of worldwide interest, and to demonstrate the many facets of the hobby of amateur radio. A special-event Jubilee 150 callsign was activated, together with the propagation, worldwide, of a unique QSL card which has been sponsored by the S.A. Department of Tourism.

The coordinators, on behalf of the WIA (S.A.) and S.A. amateurs, invited VIPs from the government, the Jubilee 150 Committee, and the Adelaide City Council, to participate in the launch. A special effort on the launch was to link up with Texas, USA, S.A.'s sister state.

A sample of the QSL card and the award will be made available for publication at a later date, and it and a full program of activities will be detailed and published in the WIA's *Amateur Radio Magazine*.

Instructor Rod VK4KAP shows the workings of a model 100 Teleprinter during the SEQTG RTTY seminar. ("You hit it here," says Rod.)

VK7—TASMANIA

Tasmania, like most of the early settlements in Australia, started out basically as a prison colony. The prison settlement of Port Arthur on the southernmost point of Tasmania was the furthest that the English could send their prisoners, using the old adage, "out of sight, out of mind," apparently.

The *very few* who did survive the trip out plus the harshness of the penal system found a gem of an island in the southern ocean that even today, because of its rugged grandeur, has not been fully explored.

Tasmania, these days, is the main port of call for fuel and provisions for all those multinational fishing fleets that fish the southern ocean; it also is the main refurbishing port for our VKØ stations in Antarctica. It is one of the main apple and potato suppliers to the mainland. That is why we call it "The Apple Isle."

The Tasmanian Devil

Tasmania is perhaps best known by DX award hunters for its Tasmanian Devil's Award, which appears to be one of the most sought after pieces of wallpaper available from "down under."

The Tasmanian Devil itself is well depicted in those Walt Disney cartoons as a whirlwind of ferocious teeth, with a sour disposition. It is said that they can be tamed by feeding them with hand-held pieces of chocolate—if you are not frightened of losing your hand, of course!

There are approximately 500 licensed amateurs within Tasmania. Of these, only 150 would be active on HF, so the latest QSL card figures I have for 1984 of around 11,015 inwards, and 7,672 outwards is equal to 51 cards each, outwards, so except for a few keen DX operators, they are not very active. This makes the above award a little harder to get, but it is well worth the extra effort.

Broadcasts

There is a local Sunday WIA news broadcast on 7.130 MHz (or Saturday at 2330 UTC) for those stations wanting to check band conditions or get more Tassie Devil contacts. There also is a net running for the Sunday broadcast info on Saturday at 0930 UTC on 3.570 that is worth checking.

RTTY

RTTY activity from the north coast of Tasmania has increased lately, courtesy of VK7NW. The main operating time is 1000 UTC on 3.625 MHz. For those interested in RTTY, other UTC broadcast times from VK2 are:

3.545	0930	VK2HL	(Horst)
7.045	0030	VK2DPM	(Alan)
14.095	0030	VK2DAY	(Rod)
21.095	0130	VK2AJP	(Joe)

Repeaters

Tasmania, being very mountainous compared with the rest of Australia, has, over its small area, four repeaters on 2-meter FM and four on 70 cm, and it is not unusual for the VK7 operators to access the VK3 or VK5 2-meter repeaters across the 300 to 500 miles of ocean between us. Direct contact on 2-meter SSB is also quite common, without large beams or power. To highlight this, the following appeared in "QRM" (the Tasmanian Division of the WIA's newsletter). It is reprinted with the permission of editor John VK7JK.

FRUSTRATION SECTION

With great aspirations for some experimental DX operating, Alan VK7ZAR and Greg VK7KJ set out at the start of a weekend in early January (at the height of summer) and headed off in the direction of Ben Lomond, 5,000 feet up. They were carrying a load of equipment covering from 6 meters to 1296 MHz and had set up HF links prior to their departure. But on their arrival, what did they find? It was blowing a gale and temperatures were down to freezing. Conditions, as Greg says, "were VKØ"—visibility nil and, with those windspeeds, no antennas either! Mike VK7ZWW had the key to the ski lodge, but where was he?? David VK7ZOT was a 1296 contact, but later on Saturday morning they had to cancel everything. To cap this story, on Saturday evening, Andy VK7ZAY in Hobart, heard a ZL calling on 144.1 SSB!! After travelling 600 km for nothing, that really was the end.

Greg VK7KJ.

VK7RY's SOUND ADVICE

If she wants a date—METER... If she wants an escort—CONDUCTOR... If she wants chocolate—FEEDER... If she's a poor cook—DISCHARGER... If she eats too much—REDUCER... If she is wrong—RECTIFIER... If her views are too narrow—AMPLIFIER... If she wants too much—RESISTOR... If she wants to marry you—ELIMINATOR... If she's a heathen—CONVERTOR... If she comes to your home—RECEIVER... If she is missing—DETECTOR... If she won't go away—TRANSMITTER... If her stays are too tight—LOOSE COUPLER... If she's too fat—WOBBULATOR.

VK7 Convention

In June, a special convention was held to help celebrate the WIA's 75th birthday. This convention was held in the Montrose Bay Yacht Club overlooking the beautiful Derwent River. It was special because never before had there been so many and so diverse events and exhibitors gathered in one place in Tasmania.

They had, for instance, a reenactment of the first spark transmission and talks by VK7AW on computer-aided design of loaded dipoles and vertical antennas. VK7ZPK gave a lecture on tracking amateur satellites by computer, while VK7ZAR talked about setting up a satellite station—the equipment required and how to work same.

There was a large amount of home-brew gear; the best crafted of this equipment was entered for the Max Loveless award (see below).

Department of Communications representatives were in attendance with all their technical expertise, plus state-of-the-art test equipment, to test (free of charge) any amateur's equipment as to its transmission or reception specifications. If either was found lacking, friendly advice was given as to the best way to solve the problem.

In all, a very successful convention, finished off with a gala dinner at the Hobart Masonic Club.

Winnie the War Winner

Max Loveless VK7ML, a former State Councillor of the Tasmanian Division of the WIA, died in April, 1971. Max, as well as being an active amateur, spent a lifetime in "real" wireless communications. He played with the newfangled gadgetry of the early 30s, worked for the ABC in Hobart prior to World War II, and spent time in the AIF on Timor during the early dark days of that conflict.

It was there that he built "Winnie the War Winner," the radio transmitter constructed on kerosene tins and built up of recovered domestic radio equipment, captured Japanese apparatus, and the remains of a low-power Australian wireless set. Until the successful contact with Darwin on this apparatus, using a Morse key made from bamboo(!), the 200-odd Australian Army personnel who had been left on Timor were thought to be either killed or POW. They had lived off the land for a

Continued on page 94

from page 86

number of months and kept 15,000 Japanese troops occupied, who could otherwise have been moving into northwest Australia. "Winnie" is now preserved in the Australian War Museum in Canberra.

Pioneer Memorial Collection

Not many amateurs have the honor of an award (or, in this case, a collection) named after them, but the Max Loveless Pioneer Memorial Collection was created by the Tasmanian Branch of the Telecom Technicians' Union (ATEA) to honor a person who used his skills in amateur radio not only to help other amateurs but also his country in a time of need. The following is an excerpt from their impressive promotional literature:

"The Tasmanian Branch of the Telecom Technicians' Union (ATEA) has decided to honour Max's name and the memory of all those people who have been engaged, by vocation or pastime, in the pioneer days of communications. The endeavours of these pioneers have brought us to the current state of the art which we now all enjoy."

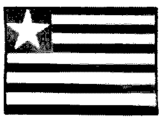
"It is intended that a collection of valve-era equipment will be gradually assembled, restored to working order, and made available for public display. Hopefully, the whole collection will be able to be eventually placed in a permanent formal museum environment, maybe through the co-operative efforts of established authorities in the area. It is not intended that this collection should compete in any way with existing endeavors by other public or private initiatives, rather, we would see our efforts as being complementary to existing endeavours by both public and private collectors. We think the preservation of actual 'communication' equipment, as distinct from telephone/exchange/telegraphy and domestic wireless, has been largely neglected. We aim to assist in filling that gap."

Obviously, if the collection is to get under way successfully, apparatus is required. In particular, the following items are eagerly sought (some limited funds are available for the purchase of such equipment):

• Old ex-service gear; in particular, we would like to get hold of an R101 or an R109 set (these were actually in use on Timor and would be fundamental to the collection), no.22, no.19, HRO, AR8, AT5, AR88, B28, B40, and similar apparatus.

• Home-brew apparatus of all types which may have been discarded in intervening years.

Should you feel able to assist us in this most worthwhile venture, please contact me by telephone in Hobart, 002 286 351, or perhaps write to: Barry Riseley, Branch Secretary, ATEA, GPO Box 215c, Hobart, Tasmania, Australia.



LIBERIA

Brother Donard Steffes, C.S.C.
EL2AL/WB8HFY
Brothers of the Holy Cross
St. Patrick High School
PO Box 1005
Monrovia
Republic of Liberia

Moses EL2BS is on the air! He may be found up and down the 20-meter band calling CQ and cheerfully picking up anyone who would like a Liberian contact. Moses operates a Drake TR-4C into a Mosley TA-33 through one hundred and fifty feet of heliax.

So...what is there to get excited about? Well, a couple of things. Moses is a young Liberian. He is a student at the University of Liberia. He came to us asking, "What is ham radio?" Now, having finished our radio course with gusto and holding his own call, he has no radio and little likelihood of getting one.

We knew that this was going to happen when we started, four years ago, a program to expand amateur radio in Liberia. We decided then that the club station was the answer. Moses operates club station EL2RL, which is the property of the Liberia Radio Amateur Association. The Drake TR-4C was donated by David Shaw PJ8DFS of the Dutch Antilles. The TA-33 is my own station antenna which I switch to the club station through the long heliax—which is another donation.

Yes, we are excited. With this station in operation we see progress and, more important than that, with his experience of operating this station, Moses has developed into an excellent operator. He runs traffic into the States for some of the local missionaries, and with this new skill he has been able to take a job as a radio operator for an international company which has offices here in Monrovia.

We have two other club stations. One is operated by a missionary in Buchanan and the other by a missionary in Gbonga. I have no details on recent activities in these two places, but I do know that they are teaching classes in amateur radio. We have tested students in these mission communities and the results are discouraging. Their success rate, like ours here in Monrovia, is very low. We could write pages of reasons for this low success rate, but let us say simply that these Liberian young people work under great handicaps. In spite of all this we see no other direction in which to go. We must offer this training in amateur radio to students, young and old, through our missionary people in the outlying areas, and set up stations for them to use—otherwise it will not be done.

When I came to Monrovia in 1980, this work of instructing and testing was already going on. The Liberia Radio Amateur Association at that time was under the leadership of Mr. Walcott Benjamin EL2BA, who was its president. Even now he is known as Mr. Amateur Radio of Liberia. Without his persistence and dedication it is doubtful that amateur radio would have survived in these parts. That is another whole story which needs to be written. Working with him was Mr. "Lee" Ruff EL2FE, who did all the technical work. Lee also wrote the examinations, and between the two of them they administered them. Lee is in engineering and management with Firestone. He keeps the plantation going.

Today we carry on. Ben EL2BA is still the power that keeps us going, though we now have the help of many other people, both native and expatriate. We hope to write into history many more success stories like that of Moses.

Give Moses a call on 20 meters between 1800 and 1900 Zulu on Monday or Wednesday. He will tell you about Liberia and its amateurs from the point of view of a native.

PROPAGATION

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA	20	40	40	40	80	80				20	15	15
AUSTRALIA	20		20		40	40	20	20			15[1]	15[1]
CANAL ZONE	15	20	20	40	40		20	20	15	15	15*	15*
ENGLAND	20	40	80	40	40		20	20	20	20	20	20
HAWAII	20		20		40	40	80	20			15[1]	15[1]
INDIA	[illegible]					20[1]	40[1]	20[1]				15[1]
JAPAN	20						20	20				20
MEXICO	15	20	20	40	40		20	20	15	15	15*	15*
PHILIPPINES							20					
PUERTO RICO	15	20	20	40	40		20	20	15	15	15*	15*
SOUTH AFRICA			40[1]	40[1]				15	15	15	20	20
U.S.S.R.	40	80	80	40			20	20	20			40
WEST COAST		80	80	40	40	40	20	20	20			

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA						80*	40*	20				
ARGENTINA	20		40	40	40						15	15
AUSTRALIA	15					40	20	20	20			15
CANAL ZONE	20	80	40	40	40	40	20	20	15	15	15	20
ENGLAND	40	40	40	80				20	15	20		40
HAWAII	15	20			40	40	40				15	15
INDIA	15[1]	20[1]	20[1]				40[1]	20[1]	20[1]			
JAPAN						80*	40*	20				
MEXICO	20	80	40	40	40	40	20	20	15	15	15	20
PHILIPPINES								20				
PUERTO RICO	20	80	40	40	40	40	20	20	15	15	15	20
SOUTH AFRICA	20	40*							15	15	20	20
U.S.S.R.	40		40	40				20	20			

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20			40	40	40	40	40			20
ARGENTINA	15	20		40	40	40	40	40		15	15	15
AUSTRALIA	15	20	20				40	80*	40	15	15	15
CANAL ZONE	20	20		40	40	40			20	15	15	15
ENGLAND			80*	40					20	20		
HAWAII	15	15			20	20	20	20				15
INDIA		20										
JAPAN	15	20			40	40	40	40	40			20
MEXICO	20	20		40	40	40			20	15	15	15
PHILIPPINES	15	20					40	40		20		20
PUERTO RICO	20	20		40	40	40			20	15	15	15
SOUTH AFRICA	20	40[1]	40[1]							15	15	20
U.S.S.R.		40[1]	40[1]	40[1]	40[1]				20	20		
EAST COAST		80	80	40	40	40	20	20	20			

1 = May be open only once or twice during month.
*** = Try next higher band.**

G = Good, F = Fair, P = Poor.

DECEMBER

SUN	MON	TUE	WED	THU	FRI	SAT
1 G	2 F	3 F	4 F	5 G	6 G	7 G
8 P	9 P	10 P	11 G	12 G	13 P	14 P
15 P	16 P	17 G	18 F	19 P	20 P	21 P
22 F	23 G	24 P	25 F	26 G	27 G	28 G
29 G	30 G	31 G				